

GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA  
PERLIS-KEDAH-PULAU PINANG  
REGIONAL WATER RESOURCES STUDY

PART 1

VOL. 3

ANNEX

C. AGRICULTURE

FEBRUARY 1984

NATIONAL WATER RESOURCES STUDY, MALAYSIA

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PERLIS-KEDAH-PULAU PINANG  
REGIONAL WATER RESOURCES STUDY

PART 1

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REGIONAL WATER RESOURCES STUDY**

**PART 1**

**VOL. 3**

**ANNEX**

**C. AGRICULTURE**

**FEBRUARY 1984**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

NATIONAL WATER RESOURCES STUDY, MALAYSIA  
 PERLIS-KEDAH-PULAU PINANG  
 REGIONAL WATER RESOURCES STUDY  
 PART 1

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## ABBREVIATIONS

### (1) Organization/Plan

4MP	:	Fourth Malaysia Plan
DID (JPT)	:	Drainage and Irrigation Department
EPU	:	Economic Planning Unit
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
GSD	:	Geological Survey Department
JICA	:	Japan International Cooperation Agency
MADA	:	Muda Agricultural Development Authority
NEB (LIN)	:	National Electricity Board
NWRS	:	National Water Resources Study
PWD (JKR)	:	Public Works Department
RISDA	:	Rubber Industry Small-Holders Development Authority
WHO	:	World Health Organization

### (2) Others

B	:	Benefit
BOD	:	Biochemical Oxygen Demand
C	:	Cost
COD	:	Chemical Oxygen Demand
D&I	:	Domestic and Industrial
dia.	:	Diameter
EIRR	:	Economic Internal Rate of Return
El.	:	Elevation Above Mean Sea Level
Eq.	:	Equation
Fig.	:	Figure
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
H	:	Height, or Water Head
NHWL	:	Normal High Water Level
O&M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SS	:	Suspended Solid

# ABBREVIATIONS OF MEASUREMENT

## Length

mm = millimeter  
cm = centimeter  
m = meter  
km = kilometer  
ft = foot  
yd = yard

## Area

cm<sup>2</sup> = square centimeter  
m<sup>2</sup> = square meter  
ha = hectare  
km<sup>2</sup> = square kilometer

## Volume

cm<sup>3</sup> = cubic centimeter  
l = lit = liter  
kl = kiloliter  
m<sup>3</sup> = cubic meter  
gal. = gallon

## Weight

mg = milligram  
g = gram  
kg = kilogram  
ton = metric ton  
lb = pound

## Time

s = second  
min = minute  
h = hour  
d = day  
y = year

## Electrical Measures

V = Volt  
A = Ampere  
Hz = Hertz (cycle)  
W = Watt  
kW = Kilowatt  
MW = Megawatt  
GW = Gigawatt

## Other Measures

% = percent  
PS = horsepower  
° = degree  
' = minute  
" = second  
°C = degree in centigrade  
10<sup>3</sup> = thousand  
10<sup>6</sup> = million  
10<sup>9</sup> = billion (milliard)

## Derived Measures

m<sup>3</sup>/s = cubic meter per second  
cusec = cubic feet per second  
mgd = million gallon per day  
kWh = kilowatt hour  
MWh = Megawatt hour  
GWh = Gigawatt hour  
kWh/y = kilowatt hour per year  
kVA = kilovolt ampere  
BTU = British thermal unit  
psi = pound per square inch

## Money

M\$ = Malaysian ringgit  
US\$ = US dollar  
¥ = Japanese Yen



## CONVERSION FACTORS

	<u>From Metric System</u>	<u>To Metric System</u>
<u>Length</u>	1 cm = 0.394 inch 1 m = 3.28 ft = 1.094 yd 1 km = 0.621 mile	1 inch = 2.54 cm 1 ft = 30.48 cm 1 yd = 91.44 cm 1 mile = 1.609 km
<u>Area</u>	1 cm <sup>2</sup> = 0.155 sq.in 1 m <sup>2</sup> = 10.76 sq.ft 1 ha = 2.471 acres k km <sup>2</sup> = 0.386 sq.mile	1 sq.ft = 0.0929 m <sup>2</sup> 1 sq.yd = 0.835 m <sup>2</sup> 1 acre = 0.4047 ha 1 sq.mile = 2.59 km <sup>2</sup>
<u>Volume</u>	1 cm <sup>3</sup> = 0.0610 cu.in 1 lit = 0.220 gal. (imp.) 1 kl = 6.29 barrels 1 m <sup>3</sup> = 35.3 cu.ft 10 <sup>6</sup> m <sup>3</sup> = 811 acre-ft	1 cu.ft = 28.32 lit 1 cu.yd = 0.765 m <sup>3</sup> 1 gal. (imp.) = 4.55 lit 1 gal. (US) = 3.79 lit 1 acre-ft = 1,233.5 m <sup>3</sup>
<u>Weight</u>	1 g = 0.0353 ounce 1 kg = 2.20 lb 1 ton = 0.984 long ton = 1.102 short ton	1 ounce = 28.35 g 1 lb = 0.4536 kg 1 long ton = 1.016 ton 1 short ton = 0.907 ton
<u>Energy</u>	1 kWh = 3,413 BTU	1 BTU = 0.293 Wh
<u>Temperature</u>	°C = (°F - 32) · 5/9	°F = 1.8°C + 32
<u>Derived Measures</u>	1 m <sup>3</sup> /s = 35.3 cusec 1 kg/cm <sup>2</sup> = 14.2 psi 1 ton/ha = 891 lb/acre 10 <sup>6</sup> m <sup>3</sup> = 810.7 acre-ft 1 m <sup>3</sup> /s = 19.0 mgd	1 cusec = 0.0283 m <sup>3</sup> /s 1 psi = 0.703 kg/cm <sup>2</sup> 1 lb/acre = 1.12 kg/ha 1 acre-ft = 1,233.5 m <sup>3</sup> 1 mgd = 0.0526 m <sup>3</sup> /s
<u>Local Measures</u>	1 lit = 0.220 gantang 1 kg = 1.65 kati 1 ton = 16.5 pikul	1 gantang = 4.55 lit 1 kati = 0.606 kg 1 pikul = 60.6 kg



***ANNEX C***  
***AGRICULTURE***



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## 1. INTRODUCTION

This Annex presents planning materials to be referred in estimating water demand for irrigated rice cultivation and for processing of tree crop harvests. Also, a study on water supply benefit in the irrigation sector is presented. All data taken into account in preparing the National Water Resources Study, Malaysia were updated on the basis of recent information additionally collected from the State Government agencies in Perlis, Kedah and Pulau Pinang during March 1983. Economic prices of rice, fertilizer, rubber and sugarcane employed in estimating irrigation water supply benefit refer to the forecasted prices by IBRD available in the 1982 issue.

## 2. BACKGROUND OF AGRICULTURE IN THE PKP REGION

### 2.1 Role of Agriculture in the PKP Region

The most important role of the PKP Region in the national economy of Malaysia is the main producer of rice in the whole country. The annual rice production in the PKP Region has shared about 62%, on an average, of the total rice production of approximately  $1.12 \times 10^6$  tons in Peninsular Malaysia. The surplus after satisfying local requirements in the PKP Region has met rice demand in the metropolitan area of Kuala Lumpur to large extent.

Notable crops other than rice grown in the PKP Region are rubber and sugarcane. The PKP Region have produced about 260,000 tons of rubber annually since 1976, sharing 18% of the total production in Peninsular Malaysia. In the PKP Region, there are two integrated sugar units with the total planted area of approximately 14,000 ha and milling capacity of 7,500 tons of cane per day. Out of 50,000 tons of raw sugar annually produced in Peninsular Malaysia, about 30,000 tons are the production of these two sugar mills.

### 2.2 Organization Responsible for Agriculture

There are various agricultural agencies involved in provision of necessary supporting services for agricultural development activities in the Region. The major Federal agencies involved are:

- Department of Drainage and Irrigation (DID),
- Department of Agriculture (DOA),
- Farmers' Organization Authority (FOA),
- Federal Agricultural Marketing Authority (FAMA),
- Bank Pertanian Malaysia (BPM),
- Rubber Industry Smallholders Development Authority (RISDA),
- Federal Land Development Authority (FELDA),
- Federal Land Consolidation and Rehabilitation Authority (FELCRA),
- National Paddy and Rice Authority (NPRA),
- Malaysian Agricultural Research and Development Institute (MARDI),
- Rubber Research Institute of Malaysia (RRIM),
- Malaysian Rubber Development Corporation (MARDEC),
- Palm Oil Research Institute of Malaysia (PORIM), and
- Palm Oil Registration and Licensing Authority (PORLA).

DID is responsible for planning, implementation, operation and maintenance of the country's drainage and irrigation schemes. DOA is responsible for agricultural extension services for which Federal DOA formulates national policies and programs and the State DOA provides the grass-root extension services. For farmers planting rubber, RISDA provides extension services. FOA is responsible for rural cooperative activities of the members of the Farmers' Cooperatives (FC). FAMA's main objective is to improve the marketing of agricultural products except oil palm, rubber, pineapple, paddy, fish and livestock which are handled by the agencies concerned. BPM or the Malaysian Agricultural Bank is the main Government institution providing agricultural credit. NPRA or the Lembaga Padi dan Beras Negara (LPN) in the Malaysian name is responsible for controlling the marketing and processing of rice and maintaining a national stockpile. MARDI is responsible for all agricultural research works with the exception of rubber and oil palm, in respect of which research is undertaken by RRIM and POLIM, respectively. The main task of FELDA is to develop new land for oil palm, rubber, sugarcane, cocoa and coffee which is later distributed to eligible persons, the majority of whom are landless farmers or smallholders owing less than 1 ha of land. FELCRA is responsible for rehabilitation of unsuccessful state land schemes and development of new land schemes at a smaller scale than FELDA. MARDEC is responsible with RISDA for setting up central rubber processing factories with a view of to improve the quality of rubber and provide market facilities for rubber smallholders. PORLA is responsible for monitoring the progress made by the various sectors of palm oil industry and ensuring an orderly development and growth of the industry through issuing licences and collecting a cess.

### 3. SOILS IN THE REGION

The information on soil condition in the Region is based on schematic reconnaissance soil surveys undertaken by MOA.

In the Region, the origins of soils extending over hilly and rolling lands mainly comprise the weathering of primary rocks such as granite, feldspar and mica, and sedimentary and metamorphic rocks such as sandstone, shale and limestone. As these soils are featured by a rather low moisture holding capacity and low nutrient status, only the soils having good depth are suitable for tree crop plantation.

The soils on terraces along steep and narrow valleys and of undulating plains are rather coarsely textured and well drained. Coupled with the seasonal fluctuation in river flow, these soils are not well suited for intensive agricultural use, especially for irrigated rice cultivation.

In the northern part of west coast area, the soils of riverine plains are of river alluvium with heavy to silty clayey texture and poorly drained. These soils are frequently overlying marine alluvium in the place close to the coast. These soils have slightly better nutrient holding capacity than hilly and terrace soils, but for obtaining optimum yield in rice cultivation much more fertilization is required due to low nitrogen and phosphate contents.

The soils observed in the west coast plains consist of marine alluvium, coarse sands, peat soils and acid sulphate soils in poorly drained swamp areas. These marine alluvial soils which extend over areas above tidal influence are suited for rice cultivation as well as tree crop plantings when provided with drainage facilities. However, acid sulphate soils have some problems for performing a large-scale land consolidation scheme due to limitation of the practical development and management methods to avoid acid sulphate production which is caused by transformation of sulphur contained in these soils.

Table 1 shows areal extent of soils in the Region. There exist alluvial soils of 1,551 km<sup>2</sup> on coastal plains, 1 km<sup>2</sup> on coastal and/or riverine, 1,169 km<sup>2</sup> on riverine flood plain or low riverine terraces, and 417 km<sup>2</sup> on intermediate and higher terraces. Sedentary soils extend over an area of 3,742 km<sup>2</sup> on undulating plains to rolling land and 3,278 km<sup>2</sup> on hills and mountains. The soils of urban and mined land cover 167 km<sup>2</sup> in total.

#### 4. PRESENT STATUS OF AGRICULTURAL PRODUCTION IN THE REGION

##### 4.1 Present Land Use

The land use survey was carried out by MOA in 1966 to 1967 and 1974 to 1975 through the interpretation of aerial photographs. The reports of the both surveys contain the textural descriptions with statistical data and the maps having varied scale of 1 inch to 1 to 3 miles in the 1966/67 survey but uniform scale of 1 inch to 2 miles in 1974/75 survey. In the 1974/75 land use map, land categories are pictured by 22 symbols for agricultural land use and by 12 symbols for non-agricultural land use. Recent issues of statistics and study reports as well as data prepared by the States' DOAs are supplementarily used for the review of present land use in the Region.

Areal extent of forested and non-forested land in the three States are as shown in Table 2 and the present status of forest activities are as shown in Table 3. The forested area in the three States totaled 4,045 km<sup>2</sup> in 1981. Among this, 844 km<sup>2</sup> have been already exploited and the rest comprise unexploited and regenerated productive forests, unproductive forests, wild life and other reserves, and uncommitted forest for development.

Present land use condition in the three States having the total area of 11,254 km<sup>2</sup> is as tabulated in Table 4. Agricultural land shares 4,838 km<sup>2</sup>, comprising paddy cultivation of 1,550 km<sup>2</sup>, rubber of 2,136 km<sup>2</sup>, mixed horticulture of 449 km<sup>2</sup>, coconut of 279 km<sup>2</sup>, oil palm of 164 km<sup>2</sup>, sugarcane of 154 km<sup>2</sup> and others.

##### 4.2 Rice Cultivation in the Region

###### 4.2.1 Cropping calendar

Cropping calendars prevailing in the three States are summarized in Table 5 and Fig. 2. Land preparation work is usually done with a range of about three months depending upon rainfall as well as availability of natural river flow in the respective rice cultivation areas. The main season cropping starts between June and August in most cases with exception of the State of Pulau Pinang starting from September. The dry season cropping starts between February and April as usual, while it starts from March in hilly areas.

The traditional farming practices which are prevailing in rainfed rice cultivation areas are to grow non-improved varieties with photo-sensitive features and long-maturity period of 150 to 180 days. Through expansion of double cropping area, improved varieties with non-photo-sensitive characteristics and early-maturity period of 135 to 150 days have been cultivated for both main and off seasons, and further this practice has become common in single cropping area provided with irrigation facilities. Presently, the average application of nitrogen fertilizer is 67 kg/ha and planting density is 10 hills/m<sup>2</sup>. Basal

fertilization is scarcely undertaken because of less effectiveness under deep water condition on main fields during pre-saturation and nursery periods.

#### 4.2.2 Planted area

Historical record on planted area of paddy since 1973/74 is as shown for each State in Table 6 and for MADA in Table 10. The total planted area of paddy in the three States has fluctuated on the level of 160,000 ha for the main season cropping.

#### 4.2.3 Paddy yield and production

As of 1982, 128,440 ha or about 80% of the total wet paddy field of 155,000 ha were provided for irrigation facilities, among while 109,594 ha or 85% could also expect irrigation water supply during the dry season. Due to irregular rainfall pattern, uncertain irrigation water supply and lack of adequate drainage system, the harvested area has been unstable resulting in fluctuation of paddy yield as shown in Tables 7 and 8.

According to the Paddy Statistics, paddy production in the three States ranged between  $0.56 \times 10^6$  tons at minimum in 1977/78 and  $1.01 \times 10^6$  tons at maximum in 1973/74 as shown in Table 9.

Table 10 shows historical record on paddy cultivation in MADA. Notable topic is a cancellation of off-season cropping in 1977/78 due to staggered cropping schedule. Actual cropping calendar from 1979 to 1982 is as illustrated in Fig. 1.

### 4.3 Tree Crops

#### 4.3.1 Rubber

In the State of Kedah, FELDA and FELCRA have concentrated their efforts for opening up new lands to plant rubber. It is reported that the total planted area of rubber as of 1981 becomes about 17,000 ha. Besides these new land development schemes, RISDA has involved in replanting schemes of smallholders' old rubber trees through introduction of high-yielding hybrids. By the end of 1981, RISDA has carried out such replanting schemes in 67% of the whole smallholders' rubber planting area of 117,700 ha in the States of Kedah and Pulau Pinang. Private rubber estates have a total area of 79,000 ha in the three States as shown in Table 11.

Rubber production in the three States shows increasing tendency in smallholders' sector resulting from the RISDA's replanting schemes under which some of high-yielding rubber trees newly introduced have become matured. As shown in Table 12, the total rubber production in the three States during 1981 was 273,400 tons.



#### 4.3.2 Oil palm

In the States of Kedah and Pulau Pinang, oil palm is grown by rubber estates of which owners have tried crop diversification by introducing oil palm at their own risk. As shown in Table 13, a total of 16,300 ha in the States of Kedah and Pulau Pinang is grown by oil palm. As the tree is a rather young and reaching to matured level, production has sharply increased from 1976. The total harvest of fresh fruit bunch recorded to be 180,000 tons in 1981 as shown in Table 14.

## 5. AGRICULTURAL DEVELOPMENT PLAN

### 5.1 Development Policy

The agricultural policy under 4MP will emphasize the improvement of the identified poverty stricken groups particularly the paddy, coconut and rubber smallholders and the fishermen. The cultivation of new and existing cash crops will be given special emphasis for further improvement of the nation's overall balance of payment and further reduction of its dependence on a limited number of foreign-exchange earning commodities. The increase in the total production of food crops and other grains will deeply be regarded to attain self-sufficiency and price stabilization at consumer level. The creation of new employment opportunities in the rural sector will also be given special emphasis.

In Peninsular Malaysia, wide variations in rainfall pattern cause shortage of water or inadequate drainage of excess water resulting in occurrence of critical periods of crop growth. Planted areas of wet paddy for both main and off seasons have fluctuated chiefly due to choronically unsteady cropping calendar in double cropping area. The major reasons consist of (1) inadequate irrigation water supply originated from lack of tertiary canals and on-farm irrigation service facilities, (2) deep-water condition during main season which often delays land preparatory work and farmers are unable to follow gazetted dates of operations and (3) delayed harvesting work of off season seldom overlapping the following main season's land preparatory and transplanting works. As a result, there have existed non-cropped wet paddy fields totalling around 5,000 ha every year for the main season cropping and double-cropped paddy areas have actually been enjoying three crops every two years. Provision for irrigation and drainage facilities is, therefore, required for modification of the natural environment and creation of physical conditions favorable to plant growth in order to stabilize agricultural production and enhance incomes particularly to the smallholders sector.

Irrigation development for the existing rainfed and irrigated single cropping areas, if technically feasible and economically sound, will contribute to significant increase in yields and in total rice production. On the other hand, some of the existing rainfed paddy field will be converted to upland or tree cropping land taking into account lack of irrigation water source or uneconomical investment required for provision of irrigation facilities.

### 5.2 Future Cropping Pattern for Irrigated Paddy Cultivation

Based on the annual isohyet, monthly distribution of rainfall and the location of irrigation areas, the growing seasons of rice are selected taking into consideration the following conditions:

- (a) most efficient use of rainfall to reduce irrigation water requirements;
- (b) completion of transplanting works before the start of the heavy monsoon rainfalls to reduce the risk of crop damage caused by excess rain water and to reduce the drainage facilities required;
- (c) separation of two growing seasons, main and off, to avoid the build-up of rice diseases and pests as well as to reduce farm labor requirements at peak time of farm operation; and
- (d) undertaking of the harvest during the dry period to envisage the introduction of mechanized harvesting.

Following these concepts, the main season wet paddy should be grown between July/October and January/March, using varieties which require about 135 days on the main field after transplanting. The off season wet paddy should be grown between February/March and July/September, using varieties which require around 105 days after transplanting to the main field. Future cropping patterns established are as shown in Figs. 3 and 4.

### 5.3 Projection of Irrigated Paddy Area

The summary of projection is as shown in Table 15 by river basin. It is considered that the development of new paddy field will be mainly concentrated along tributaries of the Kedah and Muda rivers, where runoff can secure irrigation water for the dry season cropping at a cropping intensity of 150% at minimum. The projected area of paddy field newly developed will increase by 7,700 ha during the period from 1982 to 2000.

### 5.4 Anticipated Paddy Yield

Through provision for proper irrigation water supply system and improved agricultural supporting services, increase in paddy yield could be expected to large extent. Under the condition that irrigation development will be implemented, paddy yield is anticipated to be 4.2 to 4.7 ton/ha for wet season crop and 4.8 to 5.0 ton/ha for dry season crop as shown in Table 16.

The paddy yield in proposed irrigation development areas will gradually increase from the yield level under the condition of without project and be attained to the anticipated yield with build-up period of four years.

### 5.5 Paddy Production Increase

The future paddy production increase at the full development stage of the project by sufficient irrigation water supply is estimated on the basis of the projected irrigation development area and the anticipated yield mentioned above.

In the MADA and existing minor irrigation scheme areas of which irrigation water is provided through the MADA canal system, the annual paddy production, which is expected to be 700,900 tons under the condition of insufficient water supply will increase to 883,300 tons with sufficient water supply as shown in Table 17. Along the MADA main canal, there exist rainfed paddy fields which will be newly irrigated under the proposed irrigation development scheme. Through sufficient irrigation water supply, the annual paddy production will go up from 6,600 to 28,300 tons as shown in Table 18.

In the Kedah river basin, the existing minor irrigation schemes and rainfed paddy cultivation areas will be improved in taking irrigation water for supplemental purpose in the wet season and for irrigating more than 50% of paddy fields in the dry season. As a result, the annual paddy production will increase from 500 tons to 2,200 tons in sufficiently water-supplied areas along the main stream of the Kedah river as shown in Table 19 and from 18,600 tons to 41,800 tons in the existing and newly developed minor scheme areas along the tributaries of the Kedah river as shown in Table 20.

In the Muda river basin, the existing minor irrigation schemes and rainfed paddy cultivation areas will also be able to meet irrigation water requirements fully for the wet season and more than half for the dry season through implementation of the proposed irrigation development plans. The expected increase in annual paddy production is 15,700 tons by the schemes diverting irrigation water from the main stream of the Muda river as shown in Table 21 and 24,400 tons by the schemes of which irrigation water sources are tributaries of the Muda river as shown in Table 22.

#### 5.6 Tree Crop Development

To provide basic data in estimating processing water requirement of rubber and oil palm as a component of industrial water demand, future production of rubber and oil palm is projected. For this purpose, rubber and oil palm yields are anticipated as shown in Tables 23 and 24, respectively.

The future production projected by the State is summarized in Table 25 for rubber and Table 26 for oil palm. The projection indicates the increase in rubber production from 213,000 DRC tons in 1982 to 406,000 DRC tons in 2000 in the State of Kedah and from 39,000 DRC tons in 1982 to 223,000 DRC tons in 2000 in the State of Pulau Pinang.

The processing water demand is estimated by mill or factory in the respective river basins of the Region based on the forecasted processing amount of oil palm and rubber. The results of estimation are as shown in Table 27 for palm oil mills and Table 28 for rubber factories.

## 6. AGRICULTURAL BENEFIT ATTRIBUTABLE TO WATER RESOURCES DEVELOPMENT AND MANAGEMENT

### 6.1 General

In this Study, the agricultural benefit arising from water resources development and management is composed of irrigation development benefit and flood control benefit.

The increase in the irrigation benefit is expected from the proposed irrigation schemes, to be developed during the periods of 4MP thru 7MP, which will provide irrigation water to wet paddy field fully for the wet season cropping and at least more than half for the dry season cropping. The irrigation benefit is assumed to be realized with one year delay from the start of construction works for the proposed irrigation schemes. The build-up period of intensive cropping patterns for the proposed irrigation development schemes is also assumed to be four years.

### 6.2 Economic Price of Farm Input and Output

The economic farm gate prices of rice and other internationally marketable crops as well as chemical fertilizers are derived from a projection to 1995 at 1982 constant price level. For this, international market prices forecasted by IBRD in its 1982 issue are employed. The projected farm gate prices are M\$609/ton for paddy, M\$2,920/ton for dry rubber, M\$967/ton for urea, M\$796/ton for triple superphosphate and M\$563/ton for potash. The details for the above are as shown in Tables 29 to 32.

The economic farm labor wage including family labor is estimated to be M\$8/d on the basis of MOA's information. Regarding the other farm inputs and products, annual average prices paid or received by farmers during 1980 are taken into account.

### 6.3 Economic Production Cost

The production costs estimated include seeds, fertilizer, agro-chemicals, materials and tools, fuel and oil, draft animal and machinery, employed and family labors, but these exclude taxes, water charges, land rent and repayment for initial investment.

The estimated production cost for paddy cultivation in the Region varies from 839 to 1,267 M\$/ha under insufficient water supply condition and from 962 to 1,065 M\$/ha under sufficient water supply condition, as shown in Tables 33 to 36.

#### 6.4 Economic Production Value

The economic gross production value is obtained by multiplying the anticipated crop yield by the economic farm gate price. The economic net production value is then obtained by subtracting the economic production cost from the economic gross production value. The results of calculation for the insufficient water supply condition are as shown in Tables 33 and 34, and for the sufficient water supply condition in Tables 35 and 36. The average annual net production value of tree crops is as shown in Table 37.

#### 6.5 Irrigation Benefit

Annual development schedule of tertiary development of MADA and minor irrigation scheme along tributaries of the Kedah and Muda rivers is as shown in Tables 38 to 42.

Annual disbursement schedule of financial facilities cost of tertiary system for MADA and minor irrigation schemes is as shown in Tables 43 to 47. Annual paddy planting area by MADA and minor irrigation schemes along each tributary is as shown in Tables 48 to 59.

Annual increase in paddy production by sufficient water supply is estimated to be 182,400 tons for the MADA and existing minor scheme areas along the MADA main canal, 21,700 tons for the newly developed minor scheme areas along the MADA main canal, 1,700 tons for minor scheme areas along the main stream of Kedah river, 23,100 tons for minor scheme areas along the tributaries of Kedah river, 15,700 tons for minor scheme areas along the main stream of Muda river and 24,300 tons for minor scheme areas along the tributaries of Muda river.

Economic cost and benefit streams of MADA and minor irrigation schemes along the MADA canal and the main streams of Kedah and Muda rivers are as shown in Tables 60 to 63. The summary of streams of minor irrigation schemes which will take irrigation water from the tributary without any source facility in the upstream area is as presented in Table 64 for the Kedah river basin and in Table 65 for the Muda river basin. The details of economic cost and benefit stream by tributary is as shown in Tables 66 to 69 for the Kedah river and in Tables 70 to 72 for the Muda river.

#### REFERENCES

1. RECONNAISSANCE SOIL MAP OF PENINSULAR MALAYSIA, 1968, MOA
2. SOIL-CROP SUITABILITY CLASSIFICATION FOR PENINSULAR MALAYSIA, 1978, Wong, I.F.T., MOA
3. ANNUAL REPORT ON FORESTRY IN PENINSULAR MALAYSIA 1979, Forest Department
4. PADDY STATISTICS (1967 to 1981 Editions), MOA
5. RUBBER STATISTICS HANDBOOK MALAYSIA (1976 to 1980 Editions), DOS
6. OIL PALM, COCONUT, TEA AND COCOA STATISTICS (1976 to 1980 Editions), DOS





## ***TABLES***



Table 1 AREAL EXTENT OF SOILS IN THE REGION

Unit: km<sup>2</sup>

Soils	Perlis	Kedah	P. Pinang	Region
<b>A. Alluvial Soils</b>				
Alluvial soils on coastal plains	184	965	402	1,551
Alluvial soils on coastal and/or riverine	-	-	1	1
Alluvial soils on riverine flood plain or low riverine terraces	148	935	86	1,169
Alluvial soils on intermediate and higher terraces	265	54	98	417
Sub-Total	597	1,954	587	3,138
<b>B. Sedentary Soils</b>				
Sedentary soils on undulating plains to rolling land	87	3,573	82	3,742
Sedentary soils on rolling and low hilly land	-	-	-	-
Sedentary soils on hills and mountains	103	2,995	180	3,278
Sub-Total	190	6,568	262	7,020
<b>C. Urban and Mined Land</b>				
Soils on urban and mined land	8	75	84	167
<b>Total</b>	<b>795</b>	<b>8,597</b>	<b>933</b>	<b>10,325</b>

Source; Refs. 1 and 2

Table 2 AREAL EXTENT OF FORESTED AND NON-FORESTED  
LAND IN THE STATES OF PERLIS, KEDAH AND  
PULAU PINANG AS OF 1981

Category	Perlis	Kedah	P. Pinang
Unit: ha			
1. Forested Land			
1.1 Forest reserve	7,522	339,864	6,030
1.2 Wild life & other reserves	207	-	803
1.3 Crown or state land			
- Uncommitted	10,826	-	-
- Others	-	38,745	535
Sub-total	18,555	378,609	7,368
2. Non-Forested Land			
2.1 Alienated land	39,877	355,536	89,902
2.2 Crown or state land	21,083	208,385	6,086
Sub-total	60,960	563,921	95,988
3. Total Land	79,515	942,530	103,356

Remarks; Uncommitted land includes all forest lands not under licence or any committment for development.

Source; Ref. 3

Table 3 STATUS OF FOREST ACTIVITIES IN THE STATES OF  
PERLIS, KEDAH AND PULAU PINANG AS OF 1981

			Unit: ha
Category	Perlis	Kedah	P. Pinang
1. Forest Reserve			
1.1 Productive forest	5,187	201,564	2,677
1.2 Unproductive forest	2,335	138,300	3,353
Total	7,522	339,864	6,030
2. Unproductive Forest			
2.1 Inland forest	2,335	137,012	3,353
2.2 Mangrove forest	-	1,288	-
Total	2,335	138,300	3,353
3. Productive Forest			
3.1 Inland forest	5,187	193,815	2,271
3.2 Mangrove forest	-	7,749	406
Total	5,187	201,564	2,677
4. Productive Forest			
4.1 Under working paper	-	336,980	-
4.2 Not under working paper	7,522	2,884	6,030
Total	7,522	339,864	6,030
5. Forest Cover			
5.1 Unexploited productive inland forest	401	82,392	612
5.2 Regenerated productive inland forest	-	33,462	21
5.3 Unproductive inland forest	2,335	137,012	3,353
5.4 Mangrove forest	-	9,037	406
5.5 Wild life & other reserve	207	-	803
5.6 Uncommitted & others	10,826	38,745	535
Total	13,769	300,648	5,730

Source; Ref. 3

Table 4 PRESENT LAND USE IN THE STATES OF  
PERLIS, KEDAH AND PULAU PINANG

Unit: km<sup>2</sup>

Land Use Category	Perlis	Kedah	P. Pinang
<b>1. Agricultural Land</b>			
1.1 Paddy	172	1,245	133
1.2 Rubber	41	1,841	254
1.3 Oil Palm	-	108	56
1.4 Coconut	15	112	152
1.5 Cocoa	-	6	5
1.6 Orchards	2	22	15
1.7 Pineapple	-	0	2
1.8 Sugarcane	81	73	-
1.9 Mixed Horticulture	13	354	82
1.10 Diversified Crops	5	26	9
1.11 Miscellaneous	2	6	6
Sub-total	331	3,793	714
<b>2. Non-Agricultural Land</b>			
2.1 Urban	6	52	79
2.2 Estate Building	1	11	1
2.3 Mining & Quarry	1	11	2
2.4 Grassland	27	118	19
2.5 Forest	186	3,786	74
2.6 Swamp	6	61	3
2.7 Others	237	1,593	142
Sub-total	464	5,632	320
<b>Total</b>	<b>795</b>	<b>9,425</b>	<b>1,034</b>

Table 5 TYPICAL CROPPING CALENDAR OF WET PADDY  
IN THREE STATES

State		Main Season		Off Season	
		Sowing	Harvesting	Sowing	Harvesting
Perlis	(1)	July - Oct	Nov - Feb	Mar	Aug
	(2)	Oct	Mar	Apr - June	Aug - Oct
Kedah	(1)	Aug - Sept	Jan - Feb	Feb - Mar	Aug - Sept
	(2)	Sept - Dec	Jan - Apr	Mar - June	July - Oct
	(3)	July - Aug	Jan - Feb	Mar - May	Aug - Oct
	(4)	June	Nov	Jan - Feb	May - June
P. Pinang	(1)	Sept - Dec	Jan - Apr	Apr - July	Aug - Nov
	(2)	Aug	Dec	Jan - Feb	May - June
	(3)			Apr	Sept

Table 6 HISTORICAL RECORD ON PLANTED AREA  
OF WET PADDY IN THREE STATES

Year	Season	Unit: ha		
		Perlis	Kedah	P. Pinang
1973/74	Main	26,580	118,770	17,290
	Off	13,360	90,300	13,760
1974/75	Main	26,580	118,770	15,390
	Off	13,360	91,890	16,190
1975/76	Main	26,580	118,770	15,990
	Off	16,200	94,140	14,920
1976/77	Main	26,580	118,110	13,700
	Off	12,560	89,900	13,220
1977/78	Main	26,580	120,260	13,680
	Off	-	76,400	9,540
1978/79	Main	26,580	120,320	14,250
	Off	18,330	105,530	13,080
1979/80	Main	26,520	122,470	11,410
	Off	19,660	93,440	11,410
1980/81	Main	10,360*	41,910*	11,090
	Off	5,250*	12,670*	5,730

Remarks; \*: Outside MADA

Source; Ref. 4



Table 7 HISTORICAL RECORD ON HARVESTED AREA OF  
WET PADDY IN THREE STATES

				Unit: ha
Year	Season	Perlis	Kedah	P. Pinang
1973/74	Main	26,220	118,590	17,160
	Off	13,360	90,240	13,480
1974/75	Main	26,090	118,300	14,910
	Off	13,360	91,870	15,930
1975/76	Main	26,210	118,630	15,820
	Off	16,060	94,030	14,790
1976/77	Main	23,280	116,710	13,500
	Off	12,430	89,890	13,040
1977/78	Main	20,280	94,460	13,400
	Off	-	7,640	9,530
1978/79	Main	25,770	120,280	13,730
	Off	16,230	105,520	13,080
1979/80	Main	26,200	122,470	11,330
	Off	19,590	93,440	10,940
1980/81	Main	10,000*	41,700*	11,090
	Off	5,250*	12,670*	5,500

Remarks; \*: Outside MADA

Source; Ref. 4

Table 8 HISTORICAL RECORD ON AVERAGE PADDY YIELD  
OF WET PADDY IN THREE STATES

Unit: ton/ha				
Year	Season	Perlis	Kedah	P. Pinang
1973/74	Main	3.46	3.57	3.42
	Off	3.17	3.75	3.67
1974/75	Main	3.36	3.41	3.31
	Off	3.26	3.62	3.00
1975/76	Main	3.35	3.42	3.34
	Off	4.21	4.23	3.21
1976/77	Main	3.17	3.10	2.91
	Off	4.02	3.95	2.80
1977/78	Main	2.46	3.22	3.31
	Off	-	3.93	3.34
1978/79	Main	3.56	3.69	2.97
	Off	3.59	3.91	2.75
1979/80	Main	3.62	3.75	2.41
	Off	3.72	4.04	2.37
1980/81	Main	3.31*	2.56*	2.87
	Off	2.48*	2.45*	2.96

Remarks; \*: Outside MADA

Source; Ref. 4

Table 9 HISTORICAL RECORD ON PADDY PRODUCTION  
IN THREE STATES

Year	Season	Unit: ton		
		Perlis	Kedah	P. Pinang
1973/74	Main	91,900	423,900	59,100
	Off	42,300	338,400	50,500
1974/75	Main	89,200	413,400	50,900
	Off	43,600	332,500	48,800
1975/76	Main	89,000	406,000	53,300
	Off	68,200	397,900	47,900
1976/77	Main	84,200	368,700	39,800
	Off	50,500	354,600	37,100
1977/78	Main	65,300	387,700	45,300
	Off	-	30,000	31,900
1978/79	Main	102,400	444,500	42,300
	Off	65,900	413,000	36,000
1979/80	Main	96,200	459,800	27,500
	Off	73,100	377,300	27,100
1980/81	Main	34,300*	107,240*	31,850
	Off	13,010*	30,900*	16,970

Remarks; \*: Outside MADA

Source; Ref. 4

Table 10 HISTORICAL RECORD ON PADDY CULTIVATION IN MADA

Year	Season	Harvested Area (ha)	Yield (ton/ha)	Production (ton)
1973/74	Main	95,855	3.90	373,360
	Off	85,436	4.14	353,700
1974/75	Main	95,855	4.05	388,600
	Off	88,624	4.18	370,450
1975/76	Main	95,855	3.68	353,130
	Off	88,624	4.71	417,690
1976/77	Main	95,855	3.85	368,850
	Off	88,624	4.02	355,920
1977/78	Main	95,855	3.68	353,130
	Off	-	-	-
1978/79	Main	95,855	4.27	409,690
	Off	88,624	4.68	414,410
1979/80	Main	95,855	4.80	460,200
	Off	89,463	4.54	405,980
1980/81	Main	95,855	4.66	446,970
	Off	90,204	4.40	396,990
1981/82	Main	93,239	4.70	438,410
	Off	89,528	3.27	292,490

Source; Ref. 7

Table 11 PLANTED AREA OF RUBBER BY PRODUCER  
IN THREE STATES AS OF 1981

Producer	Unit: ha		
	Perlis	Kedah	P. Pinang
Estate	477	73,300	5,225
FELDA	-	11,072	-
FELCRA	-	5,807	-
RISDA	-	66,694	12,441
Smallholder	3,620	27,202	7,764
Total	4,097	184,075	25,430

Source; Ref. 5

Table 12 RUBBER PRODUCTION BY PRODUCER IN  
THREE STATES IN 1976 AND 1981

State	Unit: DRC ton					
	1976			1981		
	Estates	Small- holders	Total	Estates	Small- holders	Total
Perlis	600	5,700	6,300	400	5,200	5,600
Kedah	92,300	115,000	207,300	104,000	126,300	230,300
P. Pinang	10,900	37,500	48,400	7,500	30,000	37,500

Source; Ref. 5

Table 13 PLANTED AREA OF OIL PALM BY PRODUCER  
IN THREE STATES AS OF 1981

Producer	Unit: ha		
	Perlis	Kedah	P. Pinang
Estates	-	10,670	4,794
FELDA	-	-	-
RISDA	-	-	-
FELCRA	-	-	-
Smallholders	-	92	759
Total	-	10,762	5,553

Source; Ref. 6

Table 14 OIL PALM PRODUCTION BY PRODUCER IN  
THREE STATES IN 1976 AND 1981

State	Unit: FFB ton					
	1976			1981		
	Estates	Public Authorities	Total	Estates	Public Authorities	Total
Perlis	-	-	-	-	-	-
Kedah	77,000	-	77,000	128,684	-	128,684
P. Pinang	43,000	-	43,000	51,305	-	51,305

Source; Ref. 6

Table 15 PROJECTED IRRIGATION AREA BY RIVER BASIN

Unit: ha

River Basin	1982		1985		1990		2000	
	Main	Off	Main	Off	Main	Off	Main	Off
Perlis								
Minor:								
Gravity/ Pump	3717	0	3717	0	3717	0	4630	2912
C/D	3637	0	3637	0	3637	0	2174	0
Sub-total	7354	0	7354	0	7354	0	6804	2912
Kedah								
MADA								
I	18500	17000	18500	17000	18400	17000	18200	17000
II	31900	30100	31700	30100	31600	30100	31200	30100
III	20900	18600	20800	18600	20600	18600	19600	18600
IV	24500	24500	24400	24400	24300	24300	24000	24000
	95800	90200	95400	90100	94900	90000	93000	89700
Minor:								
Gravity/ Pump	2080	1104	5547	3697	6268	4359	8365	6951
Sub-total	97880	91304	100947	93797	101168	94359	101365	96651
Muda								
Minor:								
Gravity/ Pump	17975	17320	20772	19943	21792	20844	24010	22405
C/D	2983	0	1530	0	1530	0	1530	0
Sub-total	20958	17320	22302	19943	23322	20844	25540	22405
Perai	1122	768	920	740	1047	867	1349	1169
P. Pinang	1126	202	1126	202	1126	202	1126	202
Total	128440	109594	132649	114682	134017	116272	136184	123339

Remarks; C/D: Control drainage scheme

Table 16 ANTICIPATED PADDY YIELD

Scheme and Season	Unit: ton/ha		
	Present Condition	With Insufficient Water Supply	With Sufficient Water Supply
<b>MADA</b>			
Main	4.0	4.0	4.7
Off			
Transplanting	4.1	4.1	5.0
Direct seeding	3.9	3.9	4.8
Construction time	-	-	3.3
<b>Minor</b>			
Main	3.4	3.4	4.2
Off	3.5	3.5	4.8
<b>Rainfed</b>			
Main	2.1	2.1	-



Table 17 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MADA MAJOR AND EXISTING  
MINOR SCHEMES ALONG MADA CANAL

Condition	Unit: ton		
	With Insufficient Water Supply	With Sufficient Water Supply	Incremental Production
Rainfed	-	-	-
Main	384,669	438,569	53,900
Off	316,275	444,765	128,490
Total	700,944	883,334	182,390

Table 18 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MINOR SCHEMES TO BE  
NEWLY DEVELOPED ALONG MADA CANAL

Condition	Unit: ton		
	With Insufficient Water Supply	With Sufficient Water Supply	Incremental Production
Rainfed	6,594	0	-6,594
Main	-	13,188	13,188
Off	-	15,072	15,072
Total	6,594	28,260	21,666

Table 19 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MINOR SCHEMES ALONG MAIN  
STREAM OF KEDAH RIVER

Condition	Unit: ton		Incremental Production
	With Insufficient Water Supply	With Sufficient Water Supply	
Rainfed	508	0	-508
Main	-	1,016	1,016
Off	-	1,162	1,162
Total	508	2,178	1,670

Table 20 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MINOR SCHEMES ALONG  
TRIBUTARIES OF KEDAH RIVER

Condition	Unit: ton		Incremental Production
	With Insufficient Water Supply	With Sufficient Water Supply	
Rainfed	6,831	0	-6,831
Main	8,609	22,272	13,663
Off	3,147	19,481	16,334
Total	18,587	41,753	23,166

Table 21 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MINOR SCHEMES ALONG  
MAIN STREAM OF MUDA RIVER

Condition	Unit: ton		Incremental Production
	With Insufficient Water Supply	With Sufficient Water Supply	
Rainfed	4,702	0	-4,702
Main	52,618	62,022	9,404
Off	53,995	64,977	10,982
Total	111,315	126,999	15,684

Table 22 INCREASED PADDY PRODUCTION BY SUFFICIENT  
WATER SUPPLY TO MINOR SCHEMES ALONG  
TRIBUTARIES OF MUDA RIVER

Condition	Unit: ton		Incremental Production
	With Insufficient Water Supply	With Sufficient Water Supply	
Rainfed	9,488	0	-9,488
Main	6,545	24,181	17,636
Off	4,764	20,971	16,207
Total	20,797	45,152	24,355

Table 23 ESTIMATED PRESENT AND ANTICIPATED FUTURE  
YIELDS OF RUBBER

Unit: DRC kg/ha

Year	Present Yield			Future Yield		
	Small- holder	FELDA	Estate	Small- holder	FELDA	Estate
1	570	790	990	570	790	990
2	570	790	990	570	790	990
3	570	790	990	570	790	990
4	570	790	990	570	790	990
5	570	790	990	570	790	990
6	570	790	990	570	790	990
7	610	830	1,045	620	880	1,080
8	650	880	1,110	670	960	1,160
9	695	930	1,180	730	1,030	1,230
10	740	980	1,250	790	1,090	1,290
11	740	980	1,250	790	1,090	1,290
12	730	975	1,240	780	1,080	1,280
13	720	970	1,230	770	1,070	1,270
14	710	965	1,220	765	1,060	1,260
15	700	960	1,210	760	1,050	1,250
16	690	955	1,200	755	1,040	1,240
17	680	950	1,190	750	1,030	1,230
18	670	945	1,185	745	1,020	1,225
19	660	940	1,180	740	1,010	1,220
20	650	935	1,175	735	1,005	1,215
21	640	930	1,170	730	1,000	1,210
22	630	925	1,165	725	995	1,205
23	620	920	1,160	720	990	1,200
24	610	915	1,155	715	985	1,195
25	600	910	1,150	710	980	1,190
26	590	905	1,145	705	975	1,185
27	580	900	1,140	700	970	1,180
28	570	900	1,135	695	965	1,175
29	570	900	1,130	690	960	1,170
30	570	900	1,130	690	960	1,170
Annual average yield	635	901	1,136	672	965	1,169

Table 24 ESTIMATED PRESENT AND ANTICIPATED FUTURE  
YIELDS OF OIL PALM

Unit: Fresh fruit bunch ton/ha

Year	Present Yield			Future Yield		
	Small- holder	FELDA	Estate	Small- holder	FELDA	Estate
1	15.1	18.1	22.0	15.1	18.1	22.0
2	15.1	18.1	22.0	15.1	18.1	22.0
3	15.1	18.1	22.0	15.1	18.1	22.0
4	15.1	18.1	22.0	15.1	18.1	22.0
5	15.1	18.1	22.0	15.1	18.1	22.0
6	15.1	18.1	22.0	15.1	18.1	22.0
7	15.1	18.1	22.0	15.8	18.7	22.5
8	15.4	18.5	22.4	16.5	19.2	23.1
9	15.9	19.1	23.1	17.5	20.4	24.5
10	16.4	19.7	23.9	18.5	21.6	25.5
11	16.4	19.7	23.9	18.5	21.6	25.5
12	16.1	19.3	23.4	18.5	21.6	25.5
13	16.1	19.3	23.4	18.3	21.3	25.2
14	15.9	19.1	23.1	18.3	21.3	25.2
15	15.6	18.7	22.7	18.0	21.0	24.9
16	15.6	18.7	22.7	18.0	21.0	24.9
17	15.6	18.7	22.7	17.5	20.4	24.5
18	15.4	18.5	22.4	17.3	20.2	24.2
19	15.4	18.5	22.4	17.0	19.8	23.8
20	15.1	18.1	22.0	16.8	19.6	23.5
21	14.9	17.9	21.7	16.8	19.6	23.5
22	14.9	17.9	21.7	16.8	19.6	23.5
23	14.6	17.5	21.2	16.5	19.2	23.1
24	14.6	17.5	21.2	16.5	19.2	23.1
25	14.6	17.5	21.2	16.5	19.2	23.1
Annual average yield	15.4	18.4	22.4	16.8	19.7	23.6

Table 25 PROJECTED PRODUCTION OF RUBBER IN THREE STATES

State	Unit: 10 <sup>3</sup> DRC tons			
	1982	1985	1990	2000
Perlis	7	7	7	7
Kedah	213	244	266	406
P. Pinang	39	127	135	223

Table 26 PROJECTED PRODUCTION OF OIL PALM IN THREE STATES

State	Unit: 10 <sup>3</sup> FFB tons			
	1982	1985	1990	2000
Perlis	-	-	-	-
Kedah	120	120	140	160
P. Pinang	48	89	91	150

Table 27 PROCESSING WATER REQUIREMENT BY PALM OIL MILL

Basin No.	Palm Oil Mill No.	Unit: 10 <sup>3</sup> m <sup>3</sup> /y			
		Water Demand			
		1982	1985	1990	2000
5	1	29	48	48	60
6	2	3	12	12	40
	3	5	23	24	80
	4	1	24	25	40

Table 28 PROCESSING WATER REQUIREMENT BY RUBBER FACTORY IN THE REGION

Unit:  $10^3 \text{ m}^3/\text{y}$

Basin No.	Rubber Factory No.	Water Requirement			
		1982	1985	1990	2000
3	1	48	51	56	66
	2	96	102	112	133
4	3	57	62	68	81
	4	57	62	68	95
	5	19	21	23	27
	6	370	394	432	610
	7	193	205	225	368
	8	386	410	450	637
	9	178	178	178	178
	11	145	158	179	312
	13	217	237	269	325
	19	70	70	70	70
5	1001	21	76	152	440
	10	25	25	25	25
	12	73	73	73	73
	14	123	123	123	123
	15	130	142	162	229
	16	294	294	294	294
	17	171	171	171	171
	18	123	123	123	123
	20	62	62	62	62
	21	37	37	37	37
6	31	620	632	649	959
	34	18	18	18	18
	36	34	34	34	34
	22	109	119	135	191
	23	173	176	180	267
	24	183	247	346	916
7	25	404	411	422	825
	26	161	164	169	330
	27	111	115	120	329
	28	27	27	27	27
	29	89	91	93	138
	30	68	68	68	68
	32	105	105	105	105
	33	31	31	31	31
	35	9	9	9	9
	1002	2	8	14	261
37	741	821	902	1,582	

Table 29 DERIVATION OF ECONOMIC FARMGATE PRICE  
OF RICE (1982 CONSTANT US\$ PRICE)

	1982	1995
<u>In US\$/ton</u>		
Export price Thai 5% broken, F.O.B. Bangkok	325	435
10% discount for quality	293	392
Ocean freight and insurance, Bangkok to Port Kelang	<u>25</u>	<u>25</u>
C.I.F. Port Kelang	318	417
<u>In M\$/ton</u>		
C.I.F. Port Kelang	747	980
Port handling charge and transport	<u>28</u>	<u>28</u>
Value at Ampang Godown	775	1,008
Inland transportation cost	38	
Milling cost	47	
Less value of by-products	<u>-18</u>	
Net cost to Ampang Godown	67	
Rice price (ready to mill)	708	941
Paddy price (65% milling rate)	461	611
Transport farm to buying center	2	2
Economic farmgate price of paddy	459	609

Remarks; Forecasted export rice price at Bangkok is referred  
to IBRD 1982 issue.



Table 30 DERIVATION OF ECONOMIC FARMGATE PRICE  
OF RUBBER (1982 CONSTANT US\$ PRICE)

	1982	1995
<u>In US\$/ton</u>		
RRSI rubber spot, New York	1,150	1,680
Ocean freight and insurance	<u>110</u>	<u>110</u>
F.O.B. Port Kelang	1,040	1,570
<u>In M\$/kg</u>		
F.O.B. Port Kelang	2,444	3,690
Handling charges, Port Kelang	21	21
Inland transportation cost	50	50
Processing cost	362	362
Processing losses	<u>337</u>	<u>337</u>
Economic dry rubber price ex-farmgate	1,674	3,920

Remarks; Forecasted RRSI rubber price at New York is referred to IBRD 1982 issue.

Table 31 DERIVATION OF ECONOMIC FARMGATE PRICE  
OF SUGARCANE (1982 CONSTANT US\$ PRICE)

	1982	1995
<u>In US\$/ton</u>		
Export price, F.O.B. Caribbean Port	250	387
Ocean freight and insurance	<u>70</u>	<u>70</u>
F.O.B. Port Kelang	320	457
<u>In M\$/ton</u>		
F.O.B. Port Kelang	736	1,051
Handling charges, Port Kelang	16	16
Inland transportation cost	50	50
Processing cost	384	384
Processing rate		7%
Economic farmgate sugarcane price	20	42

Remarks; Forecasted sugarcane price at Caribbean Port is referred to IBRD 1982 issue.

Table 32 DERIVATION OF ECONOMIC FARMGATE PRICES OF  
FERTILIZERS (1982 CONSTANT US\$ PRICE)

	1982	1995
(1) Urea		
<u>In US\$/ton</u>		
Export price, F.O.B. Europe	185	286
Ocean freight and insurance	100	100
C.I.F. Port Kelang	285	386
<u>In M\$/ton</u>		
C.I.F. Port Kelang	670	907
Port Kelang handling charge	21	21
Inland transportation cost and dealers' commission	39	39
Economic farmgate price	730	967
(2) Triple Superphosphate (TSP)		
<u>In US\$/ton</u>		
Export price, F.O.B. US Gulf	160	203
Ocean freight and insurance	110	110
C.I.F. Port Kelang	270	313
<u>In M\$/ton</u>		
C.I.F. Port Kelang	635	736
Port Kelang handling charge	21	21
Inland transportation cost and dealers' commission	39	39
Economic farmgate price	695	796
(3) Muriate of Potash		
<u>In US\$/ton</u>		
Export price, F.O.B. Vancouver	90	114
Ocean freight and insurance	100	100
C.I.F. Port Kelang	190	214
<u>In M\$/ton</u>		
C.I.F. Port Kelang	447	503
Port Kelang handling charge	21	21
Inland transportation cost and dealers' commission	39	39
Economic farmgate price	507	563

Remarks; All export prices forecasted are referred to IBRD 1982 issue.

Table 33 ECONOMIC PRODUCTION COST AND NET PRODUCTION  
VALUE OF PADDY UNDER INSUFFICIENT WATER  
SUPPLY CONDITION IN MINOR SCHEME AREA

Unit: M\$/season/ha

Item	Rainfed Main	Irrigated Main	Irrigated Off
1. Gross Production Value			
- Paddy yield (ton/ha)	2.1	3.4	3.5
- Paddy price (M\$/ton)	609	609	609
- Gross value	1,279	2,071	2,132
2. Production Cost			
- Materials	183	194	231
- Machinery	66	103	103
- Labour	560	544	568
- Miscellaneous	30	20	20
Total	839	871	922
3. Net Production Value	440	1,200	1,210

Table 34 ECONOMIC PRODUCTION COST AND NET PRODUCTION  
VALUE OF PADDY UNDER SUFFICIENT WATER  
SUPPLY CONDITION IN MINOR SCHEME AREA

Unit: M\$/season/ha

Item	Rainfed Main	Irrigated Main	Irrigated Off
1. Gross Production Value			
- Paddy yield (ton/ha)	-	4.2	4.8
- Paddy price (M\$/ton)	-	609	609
- Gross value	-	2,558	2,923
2. Production Cost			
- Materials	-	258	289
- Machinery	-	120	140
- Labour	-	560	584
- Miscellaneous	-	30	30
Total	-	968	1,043
3. Net Production Value	-	1,590	1,880

Table 35 ECONOMIC PRODUCTION COST AND NET PRODUCTION  
VALUE OF PADDY UNDER INSUFFICIENT WATER  
SUPPLY CONDITION IN MADA

Unit: M\$/season/ha

Item	Main Season Trans- planting	Off Season Trans- planting	Off Season Direct Seeding
1. Gross Production Value			
- Paddy yield (ton/ha)	4.0	4.1	3.9
- Paddy price (M\$/ton)	609	609	609
- Gross value	2,436	2,497	2,375
2. Production Cost			
- Materials	249	284	284
- Machinery	213	213	225
- Labour	704	720	616
- Miscellaneous	50	50	50
Total	1,216	1,267	1,175
3. Net Production Value			
	1,220	1,230	1,200

Table 36 ECONOMIC PRODUCTION COST AND NET PRODUCTION  
VALUE OF PADDY UNDER SUFFICIENT WATER  
SUPPLY CONDITION IN MADA

Unit: M\$/season/ha

Item	Main Season Trans- planting	Off Season Trans- planting	Off Season Direct Seeding
1. Gross Production Value			
- Paddy yield (ton/ha)	4.7	5.0	4.8
- Paddy price (M\$/ton)	609	609	609
- Gross value	2,862	3,045	2,923
2. Production Cost			
- Materials	249	284	284
- Machinery	123	151	145
- Labour	560	600	504
- Miscellaneous	30	30	30
Total	962	1,065	963
3. Net Production Value			
	1,900	1,980	1,960

Table 37

ECONOMIC NET PRODUCTION VALUE OF CROP  
FOR ESTIMATING PRODUCTION FOREGONE

Crop	Yield (ton/ha)	Price (M\$/ton)	Gross Value (M\$/ha)	Production Cost (M\$/ha)	Net Value (M\$/ha)
Rubber					
RISDA & Smallholder	0.7	3,100	2,170	870	1,300
FELDA	0.9	3,100	2,790	875	1,915
Sugarcane	49.0	42	2,058	1,548	510
Paddy (Rainfed)	2.3	609	1,400	985	415
Upland Crop (Cassava)	10.0	50	500	300	200

Table 38

ANNUAL DEVELOPMENT SCHEDULES OF TERTIARY  
SYSTEM FOR MADA AREA AND MINOR IRRIGATION  
SCHEMES ALONG MADA CANAL AND MAIN STREAMS  
OF KEDAH AND MUDA RIVERS

Unit: ha

Year	MADA			Minor Schemes			
	T/S to be Constructed	Accumulated Total		Along MADA Canal		Along Kedah River	Along Muda River
		T/S Provided	T/S Not Provided	(CHO)	(P)		
1983	4,700	4,700	91,100	-	-	-	188
1984	4,800	9,500	86,100	-	-	-	188
1985	4,800	14,300	81,100	535	100	-	259
1986	3,800	18,100	77,200	657	199	-	115
1987	3,800	21,900	73,300	395	606	-	117
1988	3,800	25,700	69,400	-	-	-	74
1989	3,800	29,500	65,500	-	-	-	657
1990	3,800	33,300	61,600	-	-	56	766
1991	5,500	38,800	56,000	-	550	90	72
1992	5,500	44,300	50,300	98	-	-	53
1993	5,600	49,900	44,500	-	-	-	-
1994	5,600	55,500	38,700	-	-	-	-
1995	5,600	61,100	32,900	-	-	-	-
1996	6,300	67,400	26,400	-	-	96	-
1997	6,400	73,800	19,800	-	-	-	-
1998	6,400	80,200	13,200	-	-	-	-
1999	6,400	86,600	6,600	-	-	-	-
2000	6,400	93,000	0	-	-	-	-
Total	93,000	-	-	1,685	1,455	242	2,489

Remarks; CHO: Control head offtake system  
P : Pump/gravity system  
T/S: Tertiary canal system

Table 39 ANNUAL DEVELOPMENT SCHEDULE OF MINOR  
IRRIGATION SCHEMES BY TRIBUTARY  
IN KEDAH BASIN (1/2)

Unit: ha

Year	Sg. Gial	Sg. Arau	Sg. Badak- Temin	Sg. Kesai	Sg. Tok- Khomis	Sg. Tekai	Sg. Jelutang	Sg. Bdg. Terap
1983	-	-	21	-	-	-	-	-
1984	-	-	21	-	-	-	-	-
1985	-	-	21	-	-	-	-	-
1986	-	-	44	-	-	-	-	-
1987	-	-	24	-	-	-	-	-
1988	-	-	24	-	-	-	30	-
1989	-	-	64	-	-	32	-	28
1990	-	-	40	-	-	20	-	116
1991	32	-	54	-	-	-	-	150
1992	-	-	50	-	-	-	-	84
1993	-	-	-	-	-	-	-	86
1994	-	-	20	-	-	20	-	20
1995	-	33	36	-	-	21	-	-
1996	28	-	-	-	-	30	-	-
1997	-	-	30	-	-	20	-	-
1998	-	-	20	-	-	20	-	-
1999	-	-	-	-	20	-	-	-
2000	-	-	-	20	-	-	-	-
<b>Total</b>	<b>60</b>	<b>33</b>	<b>469</b>	<b>20</b>	<b>20</b>	<b>163</b>	<b>30</b>	<b>484</b>

Table 40 ANNUAL DEVELOPMENT SCHEDULE OF MINOR IRRIGATION SCHEMES BY TRIBUTARY IN KEDAH BASIN (2/2)

Unit: ha

Year	Sg. Janing	Sg. Kejai	Sg. Perik	Sg. Alor Yai	Sg. Timas	Sg. Pendang	Basin Total
1983	-	-	105	-	-	66	192
1984	-	366	-	-	-	-	387
1985	-	-	-	-	-	700	721
1986	-	-	-	-	-	40	84
1987	-	-	-	-	-	52	76
1988	-	-	-	-	-	79	133
1989	-	-	-	-	-	-	84
1990	-	-	-	-	-	-	156
1991	-	-	44	-	46	20	346
1992	-	-	-	40	-	34	248
1993	20	-	-	-	-	28	154
1994	-	-	-	-	-	38	98
1995	-	-	-	-	-	20	110
1996	-	-	-	-	-	26	84
1997	-	-	-	-	-	24	74
1998	-	-	-	-	-	50	90
1999	-	-	-	-	-	80	100
2000	-	-	-	-	-	96	116
<b>Total</b>	<b>20</b>	<b>366</b>	<b>149</b>	<b>40</b>	<b>46</b>	<b>1,353</b>	<b>3,253</b>



Table 41 ANNUAL DEVELOPMENT SCHEDULE OF  
MINOR IRRIGATION SCHEMES BY  
TRIBUTARY IN MUDA BASIN (1/2)

Unit: ha

Year	Sg. Sok	Sg. Kerik	Sg. Jeneri	Sg. Begia	Sg. Chepil	Sg. Cajad
1983	-	-	-	-	-	-
1984	-	-	-	-	71	-
1985	-	-	-	-	172	-
1986	-	-	-	-	55	-
1987	-	-	-	-	110	-
1988	-	-	27	-	-	-
1989	26	-	-	-	-	-
1990	35	-	-	-	-	40
1991	31	-	-	-	-	36
1992	24	-	-	-	-	-
1993	36	-	-	-	-	-
1994	-	24	-	-	-	-
1995	-	-	35	-	-	-
1996	-	-	-	24	56	-
1997	-	-	-	-	70	-
1998	-	-	-	-	60	-
1999	-	-	-	-	105	-
2000	-	-	-	-	72	-
<b>Total</b>	<b>152</b>	<b>24</b>	<b>62</b>	<b>24</b>	<b>771</b>	<b>76</b>

Table 42 ANNUAL DEVELOPMENT SCHEDULE OF  
MINOR IRRIGATION SCHEMES BY  
TRIBUTARY IN MUDA BASIN (2/2)

Unit: ha

Year	Sg. Tembak	Sg. Ketil	Sg. Sedim	Sg. Jarak	Sg. Kulim	Basin Total
1983	-	100	66	-	-	166
1984	-	-	150	-	-	221
1985	-	40	225	-	-	437
1986	-	240	80	-	-	375
1987	-	134	81	-	-	325
1988	120	70	93	-	-	310
1989	133	46	-	-	27	232
1990	-	97	-	63	-	235
1991	-	98	48	-	-	213
1992	48	140	46	-	-	258
1993	30	62	50	-	-	178
1994	20	56	65	-	-	165
1995	-	84	68	-	-	187
1996	-	76	30	-	-	186
1997	-	116	-	-	-	186
1998	-	152	40	48	-	300
1999	-	68	56	43	-	272
2000	-	70	-	30	100	272
<b>Total</b>	<b>351</b>	<b>1,649</b>	<b>1,098</b>	<b>184</b>	<b>127</b>	<b>4,518</b>

Table 43 ANNUAL DISBURSEMENT SCHEDULES OF FINANCIAL FACILITIES COSTS FOR MADA AREA AND MINOR IRRIGATION SCHEMES ALONG MADA CANAL AND MAIN STREAMS OF KEDAH AND MUDA RIVERS

Unit: M\$10<sup>3</sup>

Year	MADA	Minor Schemes			Along Kedah River	Along Muda River
	Tertiary Development Cost	Along MADA Canal		Total Cost		
		Control Offtake	Pump or Gravity			
1983	42,938	1,445	345	1,790	-	2,407
1984	40,513	3,699	1,147	4,846	-	2,237
1985	36,888	4,877	3,351	8,228	-	1,826
1986	34,200	3,195	3,474	6,669	-	1,190
1987	34,200	1,067	2,091	3,158	-	3,012
1988	34,200	-	-	-	193	5,919
1989	38,775	-	1,898	1,898	569	6,038
1990	44,925	262	2,529	2,791	606	3,158
1991	49,763	358	1,898	2,256	311	492
1992	50,138	262	-	262	-	183
1993	50,400	-	-	-	-	-
1994	52,288	-	-	-	331	-
1995	55,075	-	-	-	442	-
1996	57,338	-	-	-	331	-
1997	57,600	-	-	-	-	-
1998	57,600	-	-	-	-	-
1999	40,400	-	-	-	-	-
2000	17,200	-	-	-	-	-
Sub-total	794,441	15,165	16,733	31,898	2,783	26,462
Sunk Cost	42,559	-	-	-	-	2,162
Total	837,000	15,165	16,733	31,898	2,783	28,624

Table 44 ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL FACILITIES COST FOR MINOR IRRIGATION SCHEMES BY TRIBUTARY IN KEDAH BASIN (1/2)

Unit: M\$10<sup>3</sup>

Year	Sg. Gial	Sg. Arau	Sg. Badak-Temin	Sg. Kesai	Sg. Tok-Khomis	Sg. Tekai	Sg. Jelutang	Sg. Bdg. Terap
1983	-	-	242	-	-	-	-	-
1984	-	-	322	-	-	-	-	-
1985	-	-	356	-	-	-	-	-
1986	-	-	345	-	-	-	104	-
1987	-	-	414	-	-	110	137	97
1988	-	-	515	-	-	217	104	528
1989	110	-	591	-	-	202	-	1,149
1990	148	-	560	-	-	69	-	1,379
1991	110	-	415	-	-	-	-	1,201
1992	-	-	242	-	-	69	-	754
1993	-	114	216	-	-	164	-	389
1994	97	152	235	-	-	271	-	69
1995	128	114	228	-	-	278	-	-
1996	97	-	206	-	-	265	-	-
1997	-	-	196	-	69	161	-	-
1998	-	-	69	69	92	69	-	-
1999	-	-	-	92	69	-	-	-
2000	-	-	-	69	-	-	-	-
Sub-total	690	380	5,152	230	230	1,875	345	5,566
Sunk Cost	-	-	242	-	-	-	-	-
Total	690	380	5,394	230	230	1,875	345	5,566

Table 45 ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL FACILITIES COST FOR MINOR IRRIGATION SCHEMES BY TRIBUTARY IN KEDAH BASIN (2/2)

Unit: M\$10<sup>3</sup>

Year	Sg. Janing	Sg. Kejai	Sg. Perik	Sg. Alor Yai	Sg. Timas	Sg. Pendang	Basin Total
1983	-	1,683	362	-	-	2,643	4,930
1984	-	1,263	-	-	-	3,358	4,943
1985	-	-	-	-	-	2,778	3,134
1986	-	-	-	-	-	651	1,100
1987	-	-	-	-	-	542	1,300
1988	-	-	-	-	-	273	1,637
1989	-	-	152	-	159	69	2,432
1990	-	-	202	138	211	209	2,916
1991	69	-	152	184	159	323	2,613
1992	92	-	-	138	-	376	1,671
1993	69	-	-	-	-	341	1,293
1994	-	-	-	-	-	313	1,137
1995	-	-	-	-	-	271	1,019
1996	-	-	-	-	-	373	941
1997	-	-	-	-	-	588	1,014
1998	-	-	-	-	-	872	1,171
1999	-	-	-	-	-	718	879
2000	-	-	-	-	-	331	400
Sub-total	230	2,946	868	460	529	15,029	34,530
Sunk Cost	-	1,263	846	-	-	531	2,882
Total	230	4,209	1,714	460	529	15,560	37,412

Table 46

ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL  
 FACILITIES COST FOR MINOR IRRIGATION  
 SCHEMES BY TRIBUTARY IN MUDA BASIN (1/2)

Unit: M\$10<sup>3</sup>

Year	Sg. Sok	Sg. Kerik	Sg. Jeneri	Sg. Begia	Sg. Chepil	Sg. Cajad
1983	-	-	-	-	920	-
1984	-	-	-	-	1,227	-
1985	-	-	-	-	1,225	-
1986	-	-	93	-	695	-
1987	90	-	125	-	380	-
1988	239	-	93	-	-	138
1989	359	-	-	-	-	308
1990	346	-	-	-	-	304
1991	341	-	-	-	-	124
1992	249	83	-	-	-	-
1993	124	110	121	-	-	-
1994	-	83	160	83	193	-
1995	-	-	121	110	500	-
1996	-	-	-	83	721	-
1997	-	-	-	-	880	-
1998	-	-	-	-	938	-
1999	-	-	-	-	694	-
2000	-	-	-	-	248	-
Sub-total	1,748	276	713	276	8,621	874
Sunk Cost	-	-	-	-	246	-
Total	1,748	276	713	276	8,867	874

Table 47

ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL  
FACILITIES COST FOR MINOR IRRIGATION  
SCHEMES BY TRIBUTARY IN MUDA BASIN (2/2)

Unit: M\$10<sup>3</sup>

Year	Sg. Tembak	Sg. Ketil	Sg. Sedim	Sg. Jarak	Sg. Kulim	Basin Total
1983	-	483	995	-	-	2,398
1984	-	1,012	1,412	-	-	3,651
1985	-	1,704	1,423	-	-	4,352
1986	414	1,688	970	-	-	3,860
1987	1,011	942	707	-	93	3,348
1988	1,026	788	321	217	124	2,946
1989	459	942	166	291	93	2,618
1990	166	1,269	379	217	-	2,681
1991	324	1,196	550	-	-	2,535
1992	372	961	612	-	-	2,277
1993	196	762	707	-	-	2,020
1994	69	841	640	-	-	2,069
1995	-	1,040	372	-	-	2,143
1996	-	1,320	242	166	-	2,532
1997	-	1,335	377	368	-	2,960
1998	-	1,078	396	468	345	3,225
1999	-	556	194	285	460	2,189
2000	-	242	-	104	345	939
Sub-total	4,037	18,159	10,463	2,116	1,460	48,743
Sunk Cost	-	805	301	-	-	1,352
Total	4,037	18,964	10,764	2,116	1,460	50,095

Table 48 PADDY PLANTING AREA UNDER THE FUTURE  
CONDITIONS OF WITH AND WITHOUT  
PROJECT IN MADA AREA

Unit: ha

Year	Without Project			With Project										
	Main Season	Off Season		T/S Not Provided			T/S Provided							
		T/P	D/S	Main	Off	T/P	Off	D/S	Main	Off	T/P	Off	D/S	Off
1982	95,800	62,583	12,584	95,800	75,100	15,100	0	0	0	0	0	0	0	0
1983	95,800	62,583	12,584	91,100	70,400	15,100	4,700	0	0	4,700	0	0	0	4,700
1984	95,800	62,583	12,584	86,100	74,200	7,600	9,500	7,500	2,700	4,800	7,500	2,700	2,700	4,800
1985	95,800	62,583	12,583	81,100	71,500	0	14,300	10,200	3,600	4,800	10,200	3,600	3,600	4,800
1986	95,800	62,583	12,584	77,200	68,800	0	18,100	12,900	4,500	3,800	12,900	4,500	4,500	3,800
1987	95,800	62,583	12,584	73,300	65,200	0	21,900	15,600	5,400	3,800	15,600	5,400	5,400	3,800
1988	95,800	62,583	12,583	69,400	61,600	0	25,700	18,300	6,300	3,800	18,300	6,300	6,300	3,800
1989	95,800	62,583	12,584	65,500	57,800	0	29,500	21,100	7,300	3,800	21,100	7,300	7,300	3,800
1990	95,800	62,583	12,584	61,600	54,000	0	33,300	23,900	8,300	3,800	23,900	8,300	8,300	3,800
1991	95,800	62,583	12,583	56,000	46,800	0	38,800	28,000	9,700	5,500	28,000	9,700	9,700	5,500
1992	95,800	62,583	12,584	50,300	41,300	0	44,300	32,100	11,100	5,500	32,100	11,100	11,100	5,500
1993	95,800	62,583	12,584	44,500	35,700	0	49,900	36,200	12,500	5,600	36,200	12,500	12,500	5,600
1994	95,800	62,583	12,583	38,700	30,200	0	55,500	40,300	13,900	5,600	40,300	13,900	13,900	5,600
1995	95,800	62,583	12,584	32,900	24,600	0	61,100	44,400	15,300	5,600	44,400	15,300	15,300	5,600
1996	95,800	62,583	12,584	26,400	17,900	0	67,400	48,800	16,900	6,300	48,800	16,900	16,900	6,300
1997	95,800	62,583	12,583	19,800	11,700	0	73,800	53,200	18,500	6,400	53,200	18,500	18,500	6,400
1998	95,800	62,583	12,584	13,200	5,700	0	80,200	57,600	20,100	6,400	57,600	20,100	20,100	6,400
1999	95,800	62,583	12,584	6,600	0	0	86,600	62,000	21,700	6,400	62,000	21,700	21,700	6,400
2000	95,800	62,583	12,583	0	0	0	93,000	66,400	23,300	6,400	66,400	23,300	23,300	6,400



Table 49

PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME AREA  
ALONG MADA CANAL AND MAIN STREAM OF KEDAH RIVER

Unit: ha

Year	Minor Scheme Along MADA Canal						Kedah River		
	Existing Area		Newly Development Area			Rainfed	Main	Off	
	Main	Off	Rainfed	Main	Off				
1982	432	165	3,140	0	0	242	0	0	
1983	432	165	3,140	0	0	242	0	0	
1984	432	165	3,140	0	0	242	0	0	
1985	432	165	2,505	635	600	242	0	0	
1986	432	165	1,649	1,491	1,456	242	0	0	
1987	432	165	648	2,492	2,492	242	0	0	
1988	432	165	648	2,492	2,492	242	0	0	
1989	432	165	648	2,492	2,492	242	0	0	
1990	432	165	648	2,492	2,492	186	56	56	
1991	432	432	98	3,042	3,042	96	146	146	
1992	432	432	0	3,140	3,140	96	146	146	
1993	432	432	0	3,140	3,140	96	146	146	
1994	432	432	0	3,140	3,140	96	146	146	
1995	432	432	0	3,140	3,140	96	146	146	
1996	432	432	0	3,140	3,140	0	242	242	
1997	432	432	0	3,140	3,140	0	242	242	
1998	432	432	0	3,140	3,140	0	242	242	
1999	432	432	0	3,140	3,140	0	242	242	
2000	432	432	0	3,140	3,140	0	242	242	

Table 50 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME AREA  
ALONG MAIN STREAM OF MUDA RIVER

Unit: ha

Year	Kedah State			P. Pinang State		
	Rainfed	Main	Off	Rainfed	Main	Off
1982	2,198	2,704	2,655	41	13,284	13,284
1983	2,010	2,892	2,892	41	13,284	13,284
1984	1,822	3,080	3,080	41	13,284	13,284
1985	1,603	3,299	3,291	41	13,284	13,284
1986	1,528	3,374	3,356	41	13,251	13,251
1987	1,440	3,462	3,434	41	13,231	13,231
1988	1,366	3,536	3,508	41	12,937	12,937
1989	709	4,193	4,165	41	12,772	12,772
1990	47	4,855	4,827	0	12,813	12,813
1991	23	4,879	4,879	0	12,813	12,813
1992	0	4,902	4,902	0	12,813	12,813
1993	0	4,902	4,902	0	12,813	12,813
1994	0	4,902	4,902	0	12,813	12,813
1995	0	4,902	4,902	0	12,813	12,813
1996	0	4,902	4,902	0	12,813	12,813
1997	0	4,902	4,902	0	12,813	12,813
1998	0	4,902	4,902	0	12,813	12,813
1999	0	4,902	4,902	0	12,813	12,813
2000	0	4,902	4,902	0	12,813	12,813

Table 51 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF KEDAH RIVER (1/5)

Unit: ha

Year	Sg. Gial			Sg. Arau			Sg. Badak - Temin		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	60	161	0	33	763	0	469	1,427	798
1983	60	161	0	33	763	0	448	1,448	798
1984	60	161	0	33	763	0	427	1,469	798
1985	60	161	0	33	763	0	406	1,490	798
1986	60	161	0	33	763	0	362	1,534	818
1987	60	161	0	33	763	0	338	1,558	818
1988	60	161	0	33	763	0	314	1,582	818
1989	60	161	0	33	763	0	290	1,606	849
1990	60	161	0	33	763	0	270	1,626	879
1991	28	193	16	33	763	0	216	1,680	1,375
1992	28	193	16	33	763	0	126	1,770	1,599
1993	28	193	16	33	763	0	106	1,790	1,599
1994	28	193	16	33	763	0	86	1,810	1,615
1995	28	193	16	0	796	796	50	1,846	1,633
1996	0	221	35	0	796	796	50	1,846	1,633
1997	0	221	35	0	796	796	20	1,876	1,648
1998	0	221	35	0	796	796	0	1,896	1,658
1999	0	221	35	0	796	796	0	1,896	1,658
2000	0	221	35	0	796	796	0	1,896	1,658

Table 52 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF KEDAH RIVER (2/5)

Unit: ha

Year	Sg. Kesai			Sg. Tok-Khomis			Sg. Tekai		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	20	0	0	20	0	0	163	0	0
1983	20	0	0	20	0	0	163	0	0
1984	20	0	0	20	0	0	163	0	0
1985	20	0	0	20	0	0	163	0	0
1986	20	0	0	20	0	0	163	0	0
1987	20	0	0	20	0	0	163	0	0
1988	20	0	0	20	0	0	163	0	0
1989	20	0	0	20	0	0	131	32	18
1990	20	0	0	20	0	0	111	52	38
1991	20	0	0	20	0	0	111	52	38
1992	20	0	0	20	0	0	111	52	38
1993	20	0	0	20	0	0	111	52	38
1994	20	0	0	20	0	0	91	72	48
1995	20	0	0	20	0	0	70	93	69
1996	20	0	0	20	0	0	40	123	79
1997	20	0	0	20	0	0	20	143	89
1998	20	0	0	20	0	0	0	163	109
1999	20	0	0	0	20	10	0	163	109
2000	0	20	10	0	20	10	0	163	109

Table 53 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF KEDAH RIVER (3/5)

Unit: ha

Year	Sg. Jelutang			Sg. Terap			Sg. Janing		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	30	0	0	484	0	0	20	137	57
1983	30	0	0	484	0	0	20	137	57
1984	30	0	0	484	0	0	20	137	57
1985	30	0	0	484	0	0	20	137	57
1986	30	0	0	484	0	0	20	137	57
1987	30	0	0	484	0	0	20	137	57
1988	0	30	15	484	0	0	20	137	57
1989	0	30	15	456	28	28	20	137	57
1990	0	30	15	340	144	144	20	137	57
1991	0	30	15	190	294	294	20	137	57
1992	0	30	15	106	378	360	20	137	57
1993	0	30	15	20	464	446	0	157	67
1994	0	30	15	0	484	456	0	157	67
1995	0	30	15	0	484	456	0	157	67
1996	0	30	15	0	484	456	0	157	67
1997	0	30	15	0	484	456	0	157	67
1998	0	30	15	0	484	456	0	157	67
1999	0	30	15	0	484	456	0	157	67
2000	0	30	15	0	484	456	0	157	67

Table 54 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF KEDAH RIVER (4/5)

Unit: ha

Year	Sg. Kejai			Sg. Perik			Sg. Alor Yai		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	366	0	0	149	0	0	40	0	0
1983	366	0	0	44	105	105	40	0	0
1984	0	366	290	44	105	105	40	0	0
1985	0	366	290	44	105	105	40	0	0
1986	0	366	290	44	105	105	40	0	0
1987	0	366	290	44	105	105	40	0	0
1988	0	366	290	44	105	105	40	0	0
1989	0	366	290	44	105	105	40	0	0
1990	0	366	290	44	105	105	40	0	0
1991	0	366	290	0	149	135	40	0	0
1992	0	366	290	0	149	135	0	40	20
1993	0	366	290	0	149	135	0	40	20
1994	0	366	290	0	149	135	0	40	20
1995	0	366	290	0	149	135	0	40	20
1996	0	366	290	0	149	135	0	40	20
1997	0	366	290	0	149	135	0	40	20
1998	0	366	290	0	149	135	0	40	20
1999	0	366	290	0	149	135	0	40	20
2000	0	366	290	0	149	135	0	40	20

Table 55 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF KEDAH RIVER (5/5)

Unit: ha

Year	Sg. Timas			Sg. Pendang			Basin Total		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	46	0	0	1,353	44	44	3,253	2,532	899
1983	46	0	0	1,287	110	110	3,061	2,724	1,070
1984	46	0	0	1,287	110	110	2,674	3,111	1,360
1985	46	0	0	587	810	307	1,953	3,832	1,557
1986	46	0	0	547	850	327	1,869	3,916	1,597
1987	46	0	0	495	902	353	1,793	3,992	1,673
1988	46	0	0	416	981	432	1,660	4,125	1,717
1989	46	0	0	416	981	432	1,576	4,209	1,794
1990	46	0	0	416	981	432	1,420	4,635	1,960
1991	0	46	23	396	1,001	443	1,074	4,711	2,686
1992	0	46	23	362	1,035	460	826	4,959	3,013
1993	0	46	23	334	1,063	474	672	5,113	3,123
1994	0	46	23	296	1,101	493	574	5,211	3,178
1995	0	46	23	276	1,121	503	464	5,321	4,023
1996	0	46	23	250	1,147	516	380	5,405	4,065
1997	0	46	23	226	1,171	540	306	5,479	4,114
1998	0	46	23	176	1,221	590	216	5,569	4,194
1999	0	46	23	96	1,301	630	116	5,669	4,244
2000	0	46	23	0	1,397	678	0	5,785	4,302

Table 56 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF MUDA RIVER (1/4)

Unit: ha

Year	Sg. Sok			Sg. Kerik			Sg. Jeneri		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	152	0	0	24	0	0	62	192	192
1983	152	0	0	24	0	0	62	192	192
1984	152	0	0	24	0	0	62	192	192
1985	152	0	0	24	0	0	62	192	192
1986	152	0	0	24	0	0	62	192	192
1987	152	0	0	24	0	0	62	192	192
1988	152	0	0	24	0	0	35	219	219
1989	126	26	26	24	0	0	35	219	219
1990	91	61	61	24	0	0	35	219	219
1991	60	92	92	24	0	0	35	219	219
1992	36	116	116	24	0	0	35	219	219
1993	0	152	134	24	0	0	35	219	219
1994	0	152	134	0	24	24	35	219	219
1995	0	152	134	0	24	24	0	254	245
1996	0	152	134	0	24	24	0	254	245
1997	0	152	134	0	24	24	0	254	245
1998	0	152	134	0	24	24	0	254	245
1999	0	152	134	0	24	24	0	254	245
2000	0	152	134	0	24	24	0	254	245



Table 57 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF MUDA RIVER (2/4)

Unit: ha

Year	Sg. Begia			Sg. Chepil			Sg. Cajad		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	24	0	0	771	91	91	76	0	0
1983	24	0	0	771	91	91	76	0	0
1984	24	0	0	700	162	162	76	0	0
1985	24	0	0	528	334	334	76	0	0
1986	24	0	0	473	389	389	76	0	0
1987	24	0	0	363	499	499	76	0	0
1988	24	0	0	363	499	499	76	0	0
1989	24	0	0	363	499	499	76	0	0
1990	24	0	0	363	499	499	36	40	20
1991	24	0	0	363	499	499	0	76	38
1992	24	0	0	363	499	499	0	76	38
1993	24	0	0	363	499	499	0	76	38
1994	24	0	0	363	499	499	0	76	38
1995	24	0	0	363	499	499	0	76	38
1996	0	24	20	307	555	555	0	76	38
1997	0	24	20	237	625	593	0	76	38
1998	0	24	20	177	685	623	0	76	38
1999	0	24	20	72	790	684	0	76	38
2000	0	24	20	0	862	724	0	76	38

Table 58 PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF MUDA RIVER (3/4)

Unit: ha

Year	Sg. Tembak			Sg. Ketil			Sg. Sedim		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	351	0	0	1,649	635	599	1,098	522	255
1983	351	0	0	1,549	735	699	1,032	547	255
1984	351	0	0	1,549	735	699	882	576	375
1985	351	0	0	1,509	775	728	657	801	443
1986	351	0	0	1,269	1,015	874	577	881	523
1987	351	0	0	1,135	1,149	1,009	496	962	600
1988	231	120	60	1,065	1,219	1,044	403	1,055	693
1989	98	253	193	1,019	1,265	1,090	403	1,055	693
1990	98	253	193	922	1,362	1,187	403	1,055	693
1991	98	253	193	824	1,460	1,285	355	1,103	741
1992	50	301	217	684	1,600	1,383	309	1,149	787
1993	20	331	232	622	1,662	1,440	259	1,199	814
1994	0	351	252	566	1,718	1,468	194	1,264	879
1995	0	351	252	482	1,802	1,523	126	1,332	913
1996	0	351	252	406	1,878	1,561	96	1,362	943
1997	0	351	252	290	1,994	1,647	96	1,362	943
1998	0	351	252	138	2,146	1,723	56	1,402	983
1999	0	351	252	70	2,214	1,757	0	1,458	1,030
2000	0	351	252	0	2,284	1,796	0	1,458	1,030

Table 59

PADDY PLANTING AREA UNDER THE FUTURE CONDITION  
OF WITH PROJECT IN MINOR IRRIGATION SCHEME  
AREA ALONG TRIBUTARY OF MUDA RIVER (4/4)

Unit: ha

Year	Sg. Jarak			Sg. Kulim			Basin Total		
	Rainfed	Main	Off	Rainfed	Main	Off	Rainfed	Main	Off
1982	184	330	133	127	155	91	4,518	1,925	1,361
1983	184	302	105	127	155	91	4,352	2,022	1,433
1984	184	302	105	127	155	91	4,131	2,122	1,624
1985	184	105	105	127	155	91	3,694	2,362	1,893
1986	184	98	98	127	155	91	3,319	2,730	2,167
1987	184	98	98	127	155	91	2,994	3,055	2,489
1988	184	98	98	127	155	91	2,684	3,365	2,704
1989	184	98	98	100	182	118	2,452	3,597	2,936
1990	121	161	161	100	182	118	2,217	3,832	3,151
1991	121	161	161	100	182	118	2,004	4,045	3,346
1992	121	161	161	100	182	118	1,746	4,303	3,538
1993	121	161	161	100	182	118	1,568	4,481	3,655
1994	121	161	161	100	182	118	1,403	4,646	3,792
1995	121	161	161	100	182	118	1,216	4,833	3,907
1996	121	161	161	100	182	118	1,030	5,019	4,051
1997	121	161	161	100	182	118	844	5,205	4,179
1998	73	209	209	100	182	118	544	5,505	4,369
1999	30	252	252	100	182	118	272	5,777	4,554
2000	0	282	282	0	282	218	0	6,049	4,763

Table 60 ECONOMIC COST AND BENEFIT STREAMS OF  
MADA MAJOR SCHEME AND EXISTING MINOR  
SCHEMES ALONG MADA CANAL

Unit: M\$10<sup>6</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	34.4	0.7	35.1	209.9	191.4	-18.5
1984	32.4	1.3	33.7	209.9	211.9	2.0
1985	29.5	2.0	31.5	209.9	214.6	4.7
1986	27.4	2.5	29.9	209.9	218.7	8.8
1987	27.4	3.1	30.5	209.9	221.0	11.1
1988	27.4	3.6	31.0	209.9	223.2	13.3
1989	31.0	4.1	35.1	209.9	225.5	15.6
1990	35.9	4.7	40.6	209.9	253.6	43.7
1991	39.8	5.4	45.2	209.9	264.8	54.9
1992	40.1	6.2	46.3	209.9	277.6	67.7
1993	40.3	7.0	47.3	209.9	291.5	81.6
1994	41.8	7.8	49.6	209.9	299.2	89.3
1995	44.1	8.6	52.7	209.9	306.7	96.8
1996	45.9	9.4	55.3	209.9	314.5	104.6
1997	46.1	10.3	56.4	209.9	322.7	112.8
1998	46.1	11.2	57.3	209.9	331.1	121.2
1999	32.3	12.1	44.4	209.9	340.0	130.1
2000	13.8	13.0	26.8	209.9	349.6	139.7
2001	-	13.0	13.0	209.9	355.3	145.4
2002	-	13.0	13.0	209.9	357.6	147.7
2003	-	13.0	13.0	209.9	359.0	149.1
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	13.0	13.0	209.9	359.0	149.1

Table 61 ECONOMIC COST AND BENEFIT STREAMS OF  
MINOR IRRIGATION SCHEMES TO BE NEWLY  
DEVELOPED ALONG MADA CANAL

Unit: M\$10<sup>6</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	1.43	--	1.43	1.38	1.38	0
1984	3.88	-	3.88	1.38	1.38	0
1985	6.60	0.07	6.67	1.38	1.94	0.56
1986	5.29	0.17	5.46	1.38	2.85	1.47
1987	2.54	0.30	2.84	1.38	4.09	2.71
1988	-	0.30	0.30	1.38	4.71	3.33
1989	1.54	0.30	1.84	1.38	5.15	3.77
1990	2.19	0.30	2.49	1.38	5.40	4.02
1991	1.83	0.37	2.20	1.38	9.88	8.50
1992	0.21	0.39	0.60	1.38	10.19	8.81
1993	-	0.39	0.39	1.38	10.57	9.19
1994	-	0.39	0.39	1.38	10.85	9.47
1995	-	0.39	0.39	1.38	10.89	9.51
1996	-	0.39	0.39	1.38	10.89	9.51
1997	-	0.39	0.39	1.38	10.89	9.51
1998	-	0.39	0.39	1.38	10.89	9.51
1999	-	0.39	0.39	1.38	10.89	9.51
2000	-	0.39	0.39	1.38	10.89	9.51
2001	-	0.39	0.39	1.38	10.89	9.51
2002	-	0.39	0.39	1.38	10.89	9.51
2003	-	0.39	0.39	1.38	10.89	9.51
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	0.39	0.39	1.38	10.89	9.51

Table 62 ECONOMIC COST AND BENEFIT STREAMS OF  
MINOR IRRIGATION SCHEMES ALONG MAIN  
STREAM OF KEDAH RIVER

Unit: M\$10<sup>6</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	-	-	-	0.11	0.11	0
1984	-	-	-	0.11	0.11	0
1985	-	-	-	0.11	0.11	0
1986	-	-	-	0.11	0.11	0
1987	-	-	-	0.11	0.11	0
1988	0.15	-	0.15	0.11	0.11	0
1989	0.47	-	0.47	0.11	0.11	0
1990	0.48	0.01	0.49	0.11	0.16	0.05
1991	0.25	0.02	0.27	0.11	0.35	0.24
1992	-	0.02	0.02	0.11	0.43	0.32
1993	-	0.02	0.02	0.11	0.52	0.41
1994	0.26	0.02	0.28	0.11	0.55	0.44
1995	0.36	0.02	0.38	0.11	0.55	0.44
1996	0.26	0.03	0.29	0.11	0.72	0.61
1997	-	0.03	0.03	0.11	0.76	0.65
1998	-	0.03	0.03	0.11	0.81	0.70
1999	-	0.03	0.03	0.11	0.84	0.73
2000	-	0.03	0.03	0.11	0.84	0.73
2001	-	0.03	0.03	0.11	0.84	0.73
2002	-	0.03	0.03	0.11	0.84	0.73
2003	-	0.03	0.03	0.11	0.84	0.73
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	0.03	0.03	0.11	0.84	0.73

Table 63 ECONOMIC COST AND BENEFIT STREAMS OF  
MINOR IRRIGATION SCHEMES ALONG MAIN  
STREAM OF MUDA RIVER

Unit: M\$10<sup>6</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	1.82	0.03	1.85	20.28	20.48	0.20
1984	1.52	0.05	1.57	20.28	20.70	0.42
1985	1.13	0.08	1.21	20.28	20.88	0.60
1986	0.74	0.10	0.84	20.26	21.18	0.92
1987	2.35	0.10	2.45	20.24	21.34	1.10
1988	4.55	0.12	4.67	19.88	21.16	1.28
1989	4.43	0.21	4.64	19.68	21.58	1.90
1990	2.12	0.31	2.43	19.68	22.40	2.72
1991	0.15	0.31	0.46	19.68	24.93	5.25
1992	0.06	0.32	0.38	19.68	25.59	5.91
1993	-	0.32	0.32	19.68	26.21	6.53
1994	-	0.32	0.32	19.68	26.54	6.86
1995	-	0.32	0.32	19.68	26.55	6.87
1996	-	0.32	0.32	19.68	26.55	6.87
1997	-	0.32	0.32	19.68	26.55	6.87
1998	-	0.32	0.32	19.68	26.55	6.87
1999	-	0.32	0.32	19.68	26.55	6.87
2000	-	0.32	0.32	19.68	26.55	6.87
2001	-	0.32	0.32	19.68	26.55	6.87
2002	-	0.32	0.32	19.68	26.55	6.87
2003	-	0.32	0.32	19.68	26.55	6.87
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	0.32	0.32	19.68	26.55	6.87

Table 64 ECONOMIC COST AND BENEFIT STREAMS OF  
WHOLE MINOR IRRIGATION SCHEMES NEWLY  
DIVERTING TRIBUTARY FLOW OF KEDAH RIVER

Unit: M\$10<sup>6</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	1,811	18	1,829	5,558	5,752	194
1984	1,248	72	1,320	5,558	6,371	813
1985	285	80	365	5,558	6,573	1,015
1986	353	81	434	5,558	6,799	1,241
1987	507	84	591	5,558	6,954	1,396
1988	710	92	802	5,558	6,993	1,435
1989	1,400	109	1,509	5,558	7,049	1,491
1990	1,917	133	2,050	5,558	7,098	1,540
1991	1,923	172	2,095	5,558	7,778	2,220
1992	1,164	197	1,361	5,558	8,218	2,660
1993	790	212	1,002	5,558	8,718	3,160
1994	868	221	1,089	5,558	9,218	3,660
1995	934	228	1,162	5,558	9,598	4,040
1996	684	231	915	5,558	9,888	4,330
1997	325	232	557	5,558	10,238	4,680
1998	239	233	472	5,558	10,358	4,800
1999	128	234	362	5,558	10,568	5,010
2000	50	234	284	5,558	10,788	5,230
2001	-	234	234	5,558	10,868	5,310
2002	-	234	234	5,558	10,918	5,360
2003	-	234	234	5,558	10,938	5,380
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	234	234	5,558	10,938	5,380



Table 65 ECONOMIC COST AND BENEFIT STREAMS OF WHOLE  
MINOR IRRIGATION SCHEMES NEWLY DIVERTING  
TRIBUTARY FLOW OF MUDA RIVER

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	1,918	18	1,936	5,945	6,160	215
1984	2,921	32	2,953	5,828	6,378	550
1985	3,481	93	3,574	5,683	6,992	1,309
1986	3,087	145	3,232	5,447	7,549	2,102
1987	2,679	191	2,870	5,430	8,437	3,007
1988	2,357	235	2,592	5,430	9,267	3,837
1989	2,095	267	2,362	5,430	10,052	4,622
1990	2,145	301	2,446	5,430	10,711	5,281
1991	2,028	330	2,358	5,430	11,546	6,116
1992	1,821	366	2,187	5,430	12,203	6,773
1993	1,618	391	2,009	5,430	12,717	7,287
1994	1,654	414	2,068	5,430	13,258	7,828
1995	1,715	439	2,154	5,430	13,723	8,293
1996	2,026	466	2,492	5,430	14,247	8,817
1997	2,368	492	2,860	5,430	14,757	9,327
1998	2,579	534	3,113	5,430	15,432	10,002
1999	1,751	573	2,324	5,430	16,044	10,614
2000	751	610	1,361	5,430	16,709	11,279
2001	-	610	610	5,430	17,066	11,636
2002	-	610	610	5,430	17,340	11,910
2003	-	610	610	5,430	17,537	12,107
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	610	610	5,430	17,537	12,107

Table 66

ECONOMIC COST AND BENEFIT STREAMS  
OF MINOR IRRIGATION SCHEMES ALONG  
TRIBUTARY OF KEDAH RIVER (1/4)

Unit: M\$10<sup>3</sup>

(1) Sg. Gial

(2) Sg. Arau

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	-	-	-	220	220	0
1984	-	-	-	220	220	0
1985	-	-	-	220	220	0
1986	-	-	-	220	220	0
1987	-	-	-	220	220	0
1988	-	-	-	220	220	0
1989	58	-	58	220	220	0
1990	118	-	118	220	220	0
1991	88	4	92	220	258	38
1992	-	4	4	220	267	47
1993	-	4	4	220	277	57
1994	78	4	82	220	287	67
1995	102	4	106	220	287	67
1996	78	8	86	220	326	106
1997	-	8	8	220	336	116
1998	-	8	8	220	345	125
1999	-	8	8	220	355	135
2000	-	8	8	220	355	135
2001	-	8	8	220	355	135
2002	-	8	8	220	355	135
2003	-	8	8	220	355	135
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	8	8	220	355	135

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	-	-	-	930	930	0
1984	-	-	-	930	930	0
1985	-	-	-	930	930	0
1986	-	-	-	930	930	0
1987	-	-	-	930	930	0
1988	-	-	-	930	930	0
1989	-	-	-	930	930	0
1990	-	-	-	930	930	0
1991	-	-	-	930	530	0
1992	-	-	-	930	930	0
1993	91	-	91	930	930	0
1994	122	-	122	930	930	0
1995	91	5	96	930	1,885	935
1996	-	5	5	930	2,065	1,135
1997	-	5	5	930	2,265	1,335
1998	-	5	5	930	2,465	1,535
1999	-	5	5	930	2,465	1,535
2000	-	5	5	930	2,465	1,535
2001	-	5	5	930	2,465	1,535
2002	-	5	5	930	2,465	1,535
2003	-	5	5	930	2,465	1,535
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	5	5	930	2,465	1,535

(3) Sg. Temin

(4) Sg. Kesai

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	194	3	197	2,884	2,894	10
1984	258	6	264	2,884	2,914	30
1985	285	9	294	2,884	2,934	50
1986	276	15	291	2,884	2,978	94
1987	331	18	349	2,884	2,994	110
1988	412	22	434	2,884	3,000	116
1989	473	31	504	2,884	3,006	122
1990	448	36	484	2,884	3,026	142
1991	332	44	376	2,884	3,246	362
1992	193	51	244	2,884	3,426	542
1993	173	51	224	2,884	3,686	802
1994	188	54	242	2,884	4,009	1,125
1995	182	59	241	2,884	4,377	1,493
1996	165	59	224	2,884	4,579	1,695
1997	157	63	220	2,884	4,750	1,866
1998	55	66	121	2,884	4,933	2,049
1999	-	66	66	2,884	5,184	2,300
2000	-	66	66	2,884	5,477	2,593
2001	-	66	66	2,884	5,622	2,738
2002	-	66	66	2,884	5,725	2,841
2003	-	66	66	2,884	5,735	2,851
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	66	66	2,884	5,735	2,851

Year	Irrigation Cost			Net Production Value		
	Capital	Incremen- tal O&M	Total	Without Project	With Project	Incre- mental
1983	-	-	-	9	9	0
1984	-	-	-	9	9	0
1985	-	-	-	9	9	0
1986	-	-	-	9	9	0
1987	-	-	-	9	9	0
1988	-	-	-	9	9	0
1989	-	-	-	9	9	0
1990	-	-	-	9	9	0
1991	-	-	-	9	9	0
1992	-	-	-	9	9	0
1993	-	-	-	9	9	0
1994	-	-	-	9	9	0
1995	-	-	-	9	9	0
1996	-	-	-	9	9	0
1997	-	-	-	9	9	0
1998	55	-	55	9	9	0
1999	74	-	74	9	9	0
2000	55	3	58	9	33	24
2001	-	3	3	9	39	30
2002	-	3	3	9	45	36
2003	-	3	3	9	51	42
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	3	3	9	51	42

Table 67

ECONOMIC COST AND BENEFIT STREAMS  
OF MINOR IRRIGATION SCHEMES ALONG  
TRIBUTARY OF KEDAH RIVER (2/4)

Unit: M\$10<sup>3</sup>

(5) Sg. Tok-Khomis

(6) Sg. Tekai

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	9	9	0
1984	-	-	-	9	9	0
1985	-	-	-	9	9	0
1986	-	-	-	9	9	0
1987	-	-	-	9	9	0
1988	-	-	-	9	9	0
1989	-	-	-	9	9	0
1990	-	-	-	9	9	0
1991	-	-	-	9	9	0
1992	-	-	-	9	9	0
1993	-	-	-	9	9	0
1994	-	-	-	9	9	0
1995	-	-	-	9	9	0
1996	-	-	-	9	9	0
1997	55	-	55	9	9	0
1998	74	-	74	9	9	0
1999	55	3	58	9	33	24
2000	-	3	3	9	39	30
2001	-	3	3	9	45	36
2002	-	3	3	9	51	42
2003	-	3	3	9	51	42
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	3	3	9	51	42

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	72	72	0
1984	-	-	-	72	72	0
1985	-	-	-	72	72	0
1986	-	-	-	72	72	0
1987	88	-	88	72	72	0
1988	174	-	174	72	72	0
1989	162	4	166	72	112	40
1990	55	7	62	72	157	85
1991	-	7	7	72	176	104
1992	55	7	62	72	195	123
1993	131	7	138	72	203	131
1994	217	10	227	72	227	155
1995	222	13	235	72	270	198
1996	212	17	229	72	314	242
1997	129	20	149	72	361	289
1998	55	23	78	72	419	347
1999	-	23	23	72	441	369
2000	-	23	23	72	456	384
2001	-	23	23	72	464	392
2002	-	23	23	72	464	392
2003	-	23	23	72	464	392
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	23	23	72	464	392

(7) Sg. Jelutang

(8) Sg. Bdg. Terap

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	13	13	0
1984	-	-	-	13	13	0
1985	-	-	-	13	13	0
1986	83	-	83	13	13	0
1987	110	-	110	13	13	0
1988	83	4	87	13	48	35
1989	-	4	4	13	58	45
1990	-	4	4	13	67	54
1991	-	4	4	13	76	63
1992	-	4	4	13	76	63
1993	-	4	4	13	76	63
1994	-	4	4	13	76	63
1995	-	4	4	13	76	63
1996	-	4	4	13	76	63
1997	-	4	4	13	76	63
1998	-	4	4	13	76	63
1999	-	4	4	13	76	63
2000	-	4	4	13	76	63
2001	-	4	4	13	76	63
2002	-	4	4	13	76	63
2003	-	4	4	13	76	63
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	4	4	13	76	63

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	213	213	0
1984	-	-	-	213	213	0
1985	-	-	-	213	213	0
1986	-	-	-	213	213	0
1987	78	-	78	213	213	0
1988	423	-	423	213	213	0
1989	919	4	923	213	243	30
1990	1,101	20	1,121	213	303	90
1991	961	41	1,002	213	501	368
1992	603	53	656	213	794	581
1993	311	65	376	213	1,048	835
1994	55	68	123	213	1,230	1,017
1995	-	68	68	213	1,304	1,091
1996	-	68	68	213	1,347	1,134
1997	-	68	68	213	1,353	1,140
1998	-	68	68	213	1,353	1,140
1999	-	68	68	213	1,353	1,140
2000	-	68	68	213	1,353	1,140
2001	-	68	68	213	1,353	1,140
2002	-	68	68	213	1,353	1,140
2003	-	68	68	213	1,353	1,140
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	68	68	213	1,353	1,140

Table 68 ECONOMIC COST AND BENEFIT STREAMS OF MINOR IRRIGATION SCHEMES ALONG TRIBUTARY OF KEDAH RIVER (3/4)

Unit: M\$10<sup>3</sup>

(9) Sg. Janing

(10) Sg. Kejai

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	242	242	0
1984	-	-	-	242	242	0
1985	-	-	-	242	242	0
1986	-	-	-	242	242	0
1987	-	-	-	242	242	0
1988	-	-	-	242	242	0
1989	-	-	-	242	242	0
1990	-	-	-	242	242	0
1991	55	-	55	242	242	0
1992	74	-	74	242	242	0
1993	55	3	58	242	266	24
1994	-	3	3	242	272	30
1995	-	3	3	242	278	36
1996	-	3	3	242	284	42
1997	-	3	3	242	284	42
1998	-	3	3	242	284	42
1999	-	3	3	242	284	42
2000	-	3	3	242	284	42
2001	-	3	3	242	284	42
2002	-	3	3	242	284	42
2003	-	3	3	242	284	42
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	3	3	242	284	42

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	1,347	-	1,347	161	161	0
1984	1,010	51	1,061	161	715	554
1985	-	51	51	161	852	691
1986	-	51	51	161	990	829
1987	-	51	51	161	1,127	966
1988	-	51	51	161	1,127	966
1989	-	51	51	161	1,127	966
1990	-	51	51	161	1,127	966
1991	-	51	51	161	1,127	966
1992	-	51	51	161	1,127	966
1993	-	51	51	161	1,127	966
1994	-	51	51	161	1,127	966
1995	-	51	51	161	1,127	966
1996	-	51	51	161	1,127	966
1997	-	51	51	161	1,127	966
1998	-	51	51	161	1,127	966
1999	-	51	51	161	1,127	966
2000	-	51	51	161	1,127	966
2001	-	51	51	161	1,127	966
2002	-	51	51	161	1,127	966
2003	-	51	51	161	1,127	966
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	51	51	161	1,127	966

(11) Sg. Perik

(12) Sg. Alor Yai

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	290	15	305	66	250	184
1984	-	15	15	66	295	229
1985	-	15	15	66	340	274
1986	-	15	15	66	384	318
1987	-	15	15	66	384	318
1988	-	15	15	66	384	318
1989	121	15	136	66	384	318
1990	162	15	177	66	384	318
1991	121	21	142	66	445	379
1992	-	21	21	66	452	386
1993	-	21	21	66	476	410
1994	-	21	21	66	491	425
1995	-	21	21	66	491	425
1996	-	21	21	66	491	425
1997	-	21	21	66	491	425
1998	-	21	21	66	491	425
1999	-	21	21	66	491	425
2000	-	21	21	66	491	425
2001	-	21	21	66	491	425
2002	-	21	21	66	491	425
2003	-	21	21	66	491	425
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	21	21	66	491	425

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	18	18	0
1984	-	-	-	18	18	0
1985	-	-	-	18	18	0
1986	-	-	-	18	18	0
1987	-	-	-	18	18	0
1988	-	-	-	18	18	0
1989	-	-	-	18	18	0
1990	111	-	111	18	18	0
1991	146	-	146	18	18	0
1992	111	6	117	18	65	47
1993	-	6	6	18	77	59
1994	-	6	6	18	89	71
1995	-	6	6	18	102	84
1996	-	6	6	18	102	84
1997	-	6	6	18	102	84
1998	-	6	6	18	102	84
1999	-	6	6	18	102	84
2000	-	6	6	18	102	84
2001	-	6	6	18	102	84
2002	-	6	6	18	102	84
2003	-	6	6	18	102	84
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	6	6	18	102	84

Table 69 ECONOMIC COST AND BENEFIT STREAMS OF MINOR IRRIGATION SCHEMES ALONG TRIBUTARY OF KEDAH RIVER (4/4)

Unit: M\$10<sup>3</sup>

(13) Sg. Timas

(14) Sg. Pendang

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	total	Without Project	With Project	Incremental
1983	-	-	-	20	20	0
1984	-	-	-	20	20	0
1985	-	-	-	20	20	0
1986	-	-	-	20	20	0
1987	-	-	-	20	20	0
1988	-	-	-	20	20	0
1989	127	-	127	20	20	0
1990	169	-	169	20	20	0
1991	127	6	133	20	74	54
1992	-	6	6	20	68	68
1993	-	6	6	20	102	82
1994	-	6	6	20	116	96
1995	-	6	6	20	116	96
1996	-	6	6	20	116	96
1997	-	6	6	20	116	96
1998	-	6	6	20	116	96
1999	-	6	6	20	116	96
2000	-	6	6	20	116	96
2001	-	6	6	20	116	96
2002	-	6	6	20	116	96
2003	-	6	6	20	116	96
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	6	6	20	116	96

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	2,114	9	2,123	807	924	117
1984	2,687	9	2,696	807	950	143
1985	2,223	107	2,330	807	1,627	820
1986	521	113	634	807	1,878	1,071
1987	434	120	554	807	2,127	1,320
1988	218	131	349	807	2,531	1,724
1989	55	131	186	807	2,580	1,773
1990	167	131	298	807	2,639	1,832
1991	258	134	392	807	2,685	1,878
1992	301	139	440	807	2,735	1,928
1993	273	143	416	807	2,805	1,998
1994	250	148	398	807	2,859	2,052
1995	217	151	368	807	2,916	2,109
1996	298	154	452	807	2,981	2,176
1997	470	158	628	807	3,095	2,288
1998	698	165	863	807	3,229	2,422
1999	574	176	750	807	3,397	2,590
2000	265	189	454	807	3,472	2,665
2001	-	189	189	807	3,526	2,719
2002	-	189	189	807	3,555	2,748
2003	-	189	189	807	3,555	2,748
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	189	189	807	3,555	2,748

Table 70

ECONOMIC COST AND BENEFIT STREAMS  
OF MINOR IRRIGATION SCHEMES ALONG  
TRIBUTARY OF MUDA RIVER (1/3)

Unit: M\$10<sup>3</sup>

(1) Sg. Sok

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	67	67	0
1984	-	-	-	67	67	0
1985	-	-	-	67	67	0
1986	-	-	-	67	67	0
1987	72	-	72	67	67	0
1988	191	-	191	67	67	0
1989	287	4	291	67	113	46
1990	277	9	286	67	185	118
1991	273	13	286	67	265	198
1992	199	16	215	67	346	279
1993	93	21	120	67	427	360
1994	-	21	21	67	462	395
1995	-	21	21	67	483	416
1996	-	21	21	67	494	427
1997	-	21	21	67	494	427
1998	-	21	21	67	494	427
1999	-	21	21	67	494	427
2000	-	21	21	67	494	427
2001	-	21	21	67	494	427
2002	-	21	21	67	494	427
2003	-	21	21	67	494	427
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	21	21	67	494	427

(2) Sg. Kerik

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	11	11	0
1984	-	-	-	11	11	0
1985	-	-	-	11	11	0
1986	-	-	-	11	11	0
1987	-	-	-	11	11	0
1988	-	-	-	11	11	0
1989	-	-	-	11	11	0
1990	-	-	-	11	11	0
1991	-	-	-	11	11	0
1992	66	-	66	11	11	0
1993	89	-	89	11	11	0
1994	66	3	69	11	53	42
1995	-	3	3	11	63	52
1996	-	3	3	11	74	63
1997	-	3	3	11	84	73
1998	-	3	3	11	84	73
1999	-	3	3	11	84	73
2000	-	3	3	11	84	73
2001	-	3	3	11	84	73
2002	-	3	3	11	84	73
2003	-	3	3	11	84	73
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	3	3	11	84	73

(3) Sg. Jeneri

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	490	490	0
1984	-	-	-	490	490	0
1985	-	-	-	490	490	0
1986	74	-	74	490	490	0
1987	100	-	100	490	490	0
1988	74	4	78	490	537	47
1989	-	4	4	490	549	59
1990	-	4	4	490	560	70
1991	-	4	4	490	572	82
1992	-	4	4	490	572	82
1993	97	4	101	490	572	82
1994	128	4	132	490	572	82
1995	97	9	106	490	623	133
1996	-	9	9	490	687	197
1997	-	9	9	490	763	273
1998	-	9	9	490	852	362
1999	-	9	9	490	852	362
2000	-	9	9	490	852	362
2001	-	9	9	490	852	362
2002	-	9	9	490	852	362
2003	-	9	9	490	852	362
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	9	9	490	852	362

(4) Sg. Begia

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	11	11	0
1984	-	-	-	11	11	0
1985	-	-	-	11	11	0
1986	-	-	-	11	11	0
1987	-	-	-	11	11	0
1988	-	-	-	11	11	0
1989	-	-	-	11	11	0
1990	-	-	-	11	11	0
1991	-	-	-	11	11	0
1992	-	-	-	11	11	0
1993	-	-	-	11	11	0
1994	66	-	66	11	11	0
1995	89	-	89	11	11	0
1996	66	3	69	11	49	38
1997	-	3	3	11	58	47
1998	-	3	3	11	67	56
1999	-	3	3	11	76	65
2000	-	3	3	11	76	65
2001	-	3	3	11	76	65
2002	-	3	3	11	76	65
2003	-	3	3	11	76	65
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	3	3	11	76	65

Table 71 ECONOMIC COST AND BENEFIT STREAMS OF MINOR IRRIGATION SCHEMES ALONG TRIBUTARY OF MUDA RIVER (2/3)

Unit: M\$10<sup>3</sup>

(5) Sg. Chepil

(6) Sg. Cajad

Unit: M\$10<sup>3</sup>

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	735	-	735	559	559	0
1984	982	10	992	559	603	124
1985	980	34	1,014	559	1,015	456
1986	556	42	598	559	1,215	656
1987	304	57	361	559	1,535	976
1988	-	57	57	559	1,678	1,119
1989	-	57	57	559	1,749	1,190
1990	-	57	57	559	1,795	1,236
1991	-	57	57	559	1,795	1,236
1992	-	57	57	559	1,795	1,236
1993	-	57	57	559	1,795	1,236
1994	154	57	211	559	1,795	1,236
1995	400	57	457	559	1,795	1,236
1996	577	65	642	559	1,894	1,335
1997	704	75	779	559	2,003	1,444
1998	750	83	833	559	2,120	1,561
1999	555	59	614	559	2,317	1,758
2000	199	109	307	559	2,481	1,922
2001	-	108	108	559	2,556	1,997
2002	-	108	108	559	2,613	2,054
2003	-	108	108	559	2,636	2,077
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	108	108	559	2,636	2,077

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	33	33	0
1984	-	-	-	33	33	0
1985	-	-	-	33	33	0
1986	-	-	-	33	33	0
1987	-	-	-	33	33	0
1988	110	-	110	33	33	0
1989	247	-	247	33	33	0
1990	243	6	249	33	80	47
1991	99	11	110	33	135	102
1992	-	11	11	33	158	125
1993	-	11	11	33	181	148
1994	-	11	11	33	192	159
1995	-	11	11	33	192	159
1996	-	11	11	33	192	159
1997	-	11	11	33	192	159
1998	-	11	11	33	192	159
1999	-	11	11	33	192	159
2000	-	11	11	33	192	159
2001	-	11	11	33	192	159
2002	-	11	11	33	192	159
2003	-	11	11	33	192	159
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	11	11	33	192	159

(7) Sg. Tembak

(8) Sg. Ketil

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	154	154	0
1984	-	-	-	154	154	0
1985	-	-	-	154	154	0
1986	331	-	331	154	154	0
1987	809	-	809	154	154	0
1988	821	17	838	154	295	141
1989	367	35	402	154	565	411
1990	133	-	169	154	658	504
1991	259	-	294	154	751	597
1992	296	42	340	154	864	710
1993	157	46	203	154	914	760
1994	55	49	104	154	973	819
1995	-	49	49	154	1,005	851
1996	-	49	49	154	1,023	869
1997	-	49	49	154	1,031	877
1998	-	49	49	154	1,031	877
1999	-	49	49	154	1,031	877
2000	-	49	49	154	1,031	877
2001	-	49	49	154	1,031	877
2002	-	49	49	154	1,031	877
2003	-	49	49	154	1,031	877
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	49	49	154	1,031	877

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	386	14	400	2,212	2,387	175
1984	810	14	824	2,212	2,430	218
1985	1,363	20	1,383	2,212	2,502	290
1986	1,350	53	1,403	2,212	2,829	617
1987	754	72	826	2,212	3,128	916
1988	630	82	712	2,212	3,339	1,127
1989	754	88	842	2,212	3,571	1,359
1990	1,015	102	1,117	2,212	3,766	1,554
1991	957	116	1,073	2,212	4,199	1,987
1992	769	135	904	2,212	4,489	2,287
1993	610	144	754	2,212	4,731	2,519
1994	673	152	825	2,212	4,955	2,743
1995	832	163	995	2,212	5,163	2,951
1996	1,056	174	1,230	2,212	5,329	3,117
1997	1,068	190	1,258	2,212	5,566	3,354
1998	862	212	1,074	2,212	5,839	3,627
1999	445	221	666	2,212	6,031	3,819
2000	193	231	424	2,212	6,227	4,015
2001	-	231	231	2,212	6,316	4,104
2002	-	231	231	2,212	6,359	4,147
2003	-	231	231	2,212	6,381	4,169
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
2032	-	231	231	2,212	6,381	4,169

Table 72

ECONOMIC COST AND BENEFIT STREAMS  
OF MINOR IRRIGATION SCHEMES ALONG  
TRIBUTARY OF MUDA RIVER (3/3)

Unit: M\$10<sup>3</sup>

(9) Sg. Sedim

(10) Sg. Jerak

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	796	4	800	1,418	1,458	40
1984	1,123	8	1,137	1,369	1,577	208
1985	1,138	39	1,177	1,224	1,787	563
1986	776	50	826	1,224	2,053	829
1987	566	62	628	1,224	2,339	1,115
1988	257	75	332	1,224	2,627	1,403
1989	133	75	208	1,224	2,734	1,510
1990	303	75	378	1,224	2,807	1,583
1991	440	81	521	1,224	2,931	1,707
1992	489	88	577	1,224	3,032	1,808
1993	566	95	661	1,224	3,133	1,909
1994	512	104	616	1,224	3,303	2,079
1995	297	113	410	1,224	3,446	2,222
1996	194	118	312	1,224	3,563	2,339
1997	302	118	420	1,224	3,624	2,400
1998	117	123	240	1,224	3,727	2,503
1999	155	131	286	1,224	3,845	2,621
2000	-	131	131	1,224	3,884	2,660
2001	-	131	131	1,224	3,922	2,698
2002	-	131	131	1,224	3,944	2,720
2003	-	131	131	1,224	3,944	2,720
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	-	-	-	-	-	-
2012	-	131	131	1,224	3,944	2,720

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	638	638	0
1984	-	-	-	570	570	0
1985	-	-	-	570	570	0
1986	-	-	-	334	334	0
1987	-	-	-	317	317	0
1988	174	-	174	317	317	0
1989	233	-	233	317	317	0
1990	174	9	183	317	427	110
1991	-	9	9	317	454	137
1992	-	9	9	317	481	164
1993	-	9	9	317	508	191
1994	-	9	9	317	508	191
1995	-	9	9	317	508	191
1996	133	9	142	317	508	191
1997	294	9	303	317	508	191
1998	374	16	390	317	592	275
1999	228	22	250	317	688	371
2000	83	26	109	317	779	462
2001	-	26	26	317	831	514
2002	-	26	26	317	862	545
2003	-	26	26	317	875	558
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	-	-	-	-	-	-
2012	-	26	26	317	875	558

(11) Sg. Kulim

Year	Irrigation Cost			Net Production Value		
	Capital	Incremental O&M	Total	Without Project	With Project	Incremental
1983	-	-	-	352	352	0
1984	-	-	-	352	352	0
1985	-	-	-	352	352	0
1986	-	-	-	352	352	0
1987	74	-	74	352	352	0
1988	100	-	100	352	352	0
1989	74	4	78	352	399	47
1990	-	4	4	352	411	59
1991	-	4	4	352	422	70
1992	-	4	4	352	434	82
1993	-	4	4	352	434	82
1994	-	4	4	352	434	82
1995	-	4	4	352	434	82
1996	-	4	4	352	434	82
1997	-	4	4	352	434	82
1998	276	4	280	352	434	82
1999	368	4	372	352	434	82
2000	276	18	294	352	609	257
2001	-	18	18	352	712	360
2002	-	18	18	352	833	481
2003	-	18	18	352	972	620
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	-	-	-	-	-	-
2008	-	-	-	-	-	-
2009	-	-	-	-	-	-
2010	-	-	-	-	-	-
2011	-	-	-	-	-	-
2012	-	18	18	352	972	620



## ***FIGURES***



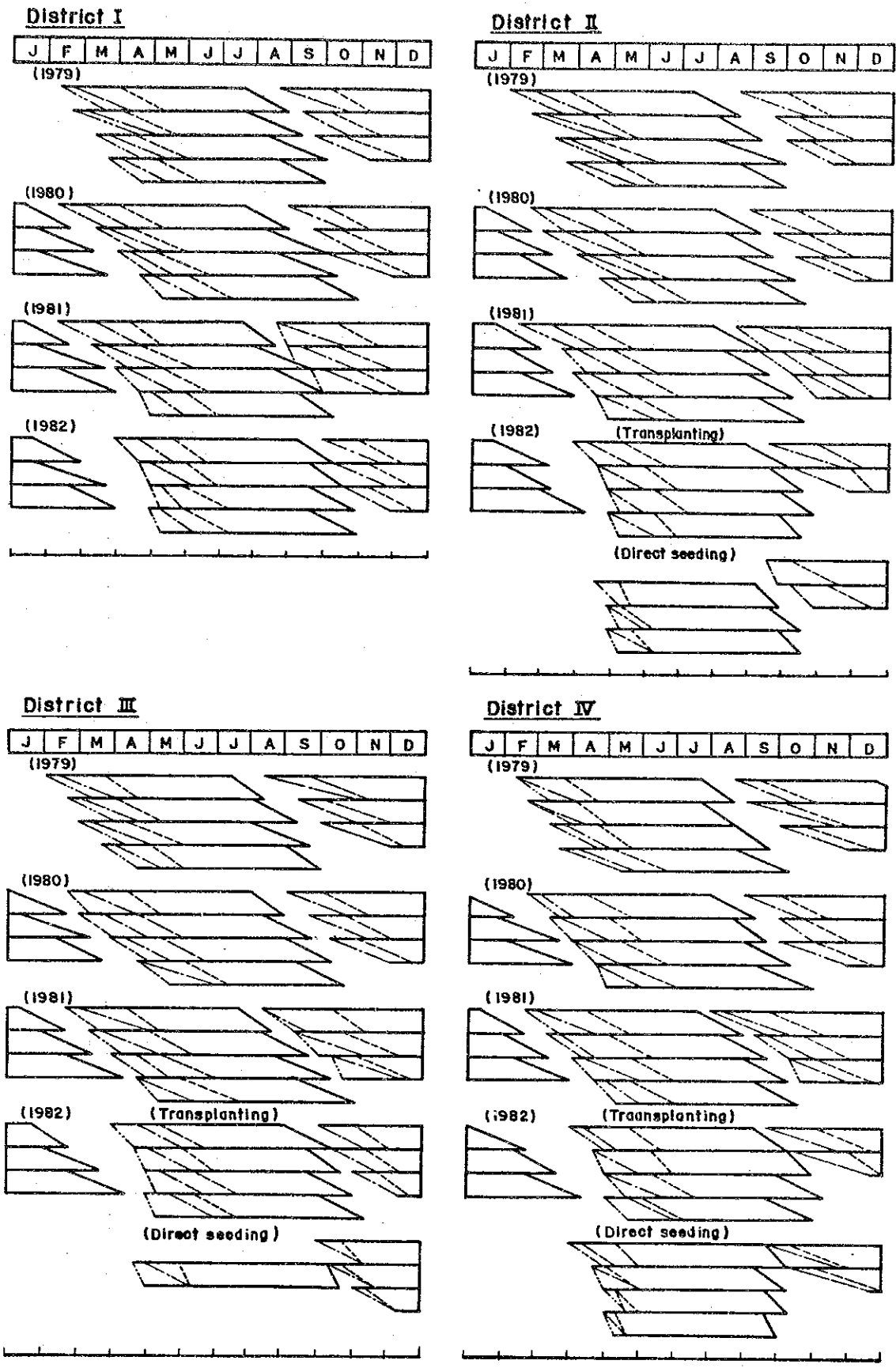
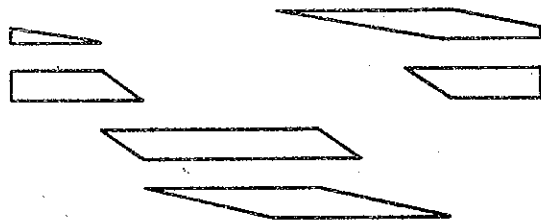


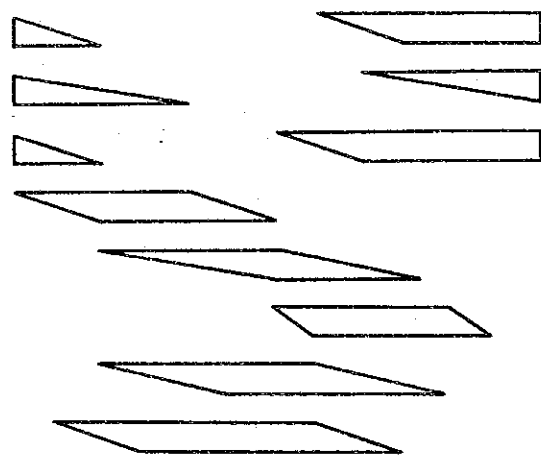
Fig. 1 Actual Cropping Calendar in the MADA Area from 1979 to 1982

J F M A M J J A S O N D

Schemes in Perlis



Schemes in Kedah



Schemes in Pulau Pinang

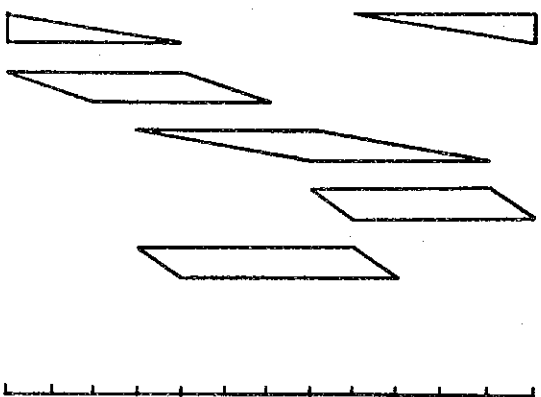
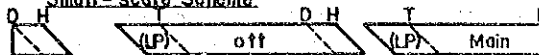


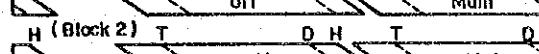
Fig. 2 Present Cropping Calendar in the Region

J F M A M J J A S O N D

Small-scale Scheme



Sg. Muda & Sg. Kulim



Pinang Tunggal & Jarak

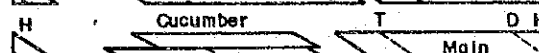
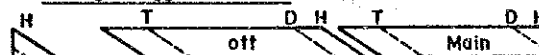


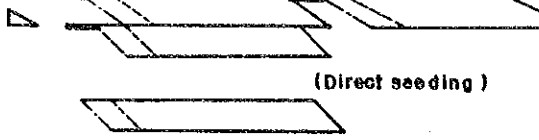
Fig. 3 Future Cropping Calendar in the Region

**Year 1990**

J F M A M J J A S O N D

**District I**

**Tertiary development area (Transplanting)**



(Direct seeding)

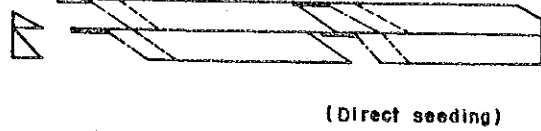
**Non-development area (Transplanting)**



J F M A M J J A S O N D

**District II**

**Tertiary development area (Transplanting)**



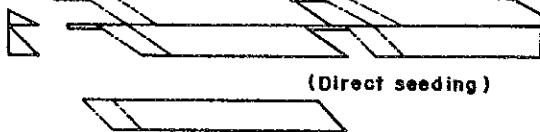
(Direct seeding)

**Non-development area (Transplanting)**



**District III**

**Tertiary development area (Transplanting)**



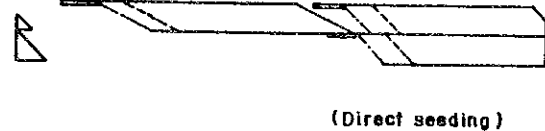
(Direct seeding)

**Non-development area (Transplanting)**



**District IV**

**Tertiary development area (Transplanting)**



(Direct seeding)

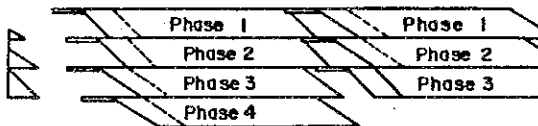
**Non-development area (Transplanting)**



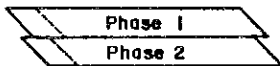
**Year 2000**

J F M A M J J A S O N D

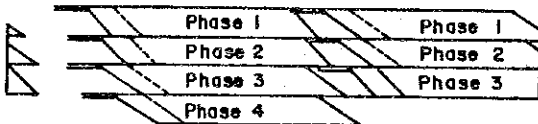
**Tertiary development area  
District I (Transplanting)**



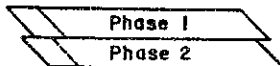
(Direct seeding)



**District III (Transplanting)**

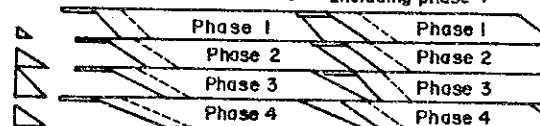


(Direct seeding)

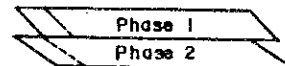


J F M A M J J A S O N D

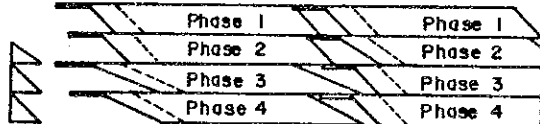
**Tertiary development area  
District II (Transplanting) Including phase 4**



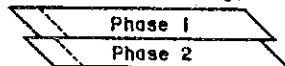
(Direct seeding)



**District IV (Transplanting)**



(Direct seeding)



**Fig. 4 Future Cropping Calendar in the MADA Area**





SECRET